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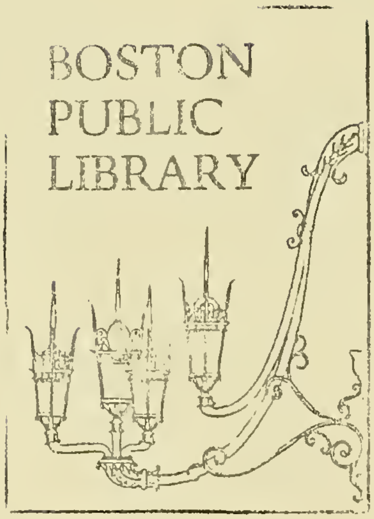

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The Port of Boston:
Future Demand for Cargo-Handling Facilities
and Its Implications

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The Port of Boston:
Future Demand for Cargo-Handling Facilities
and Its Implications

prepared for
Massachusetts Port Authority
Boston, Massachusetts

by a study team from
The Department of City and Regional Planning
of Harvard University

February, 1977

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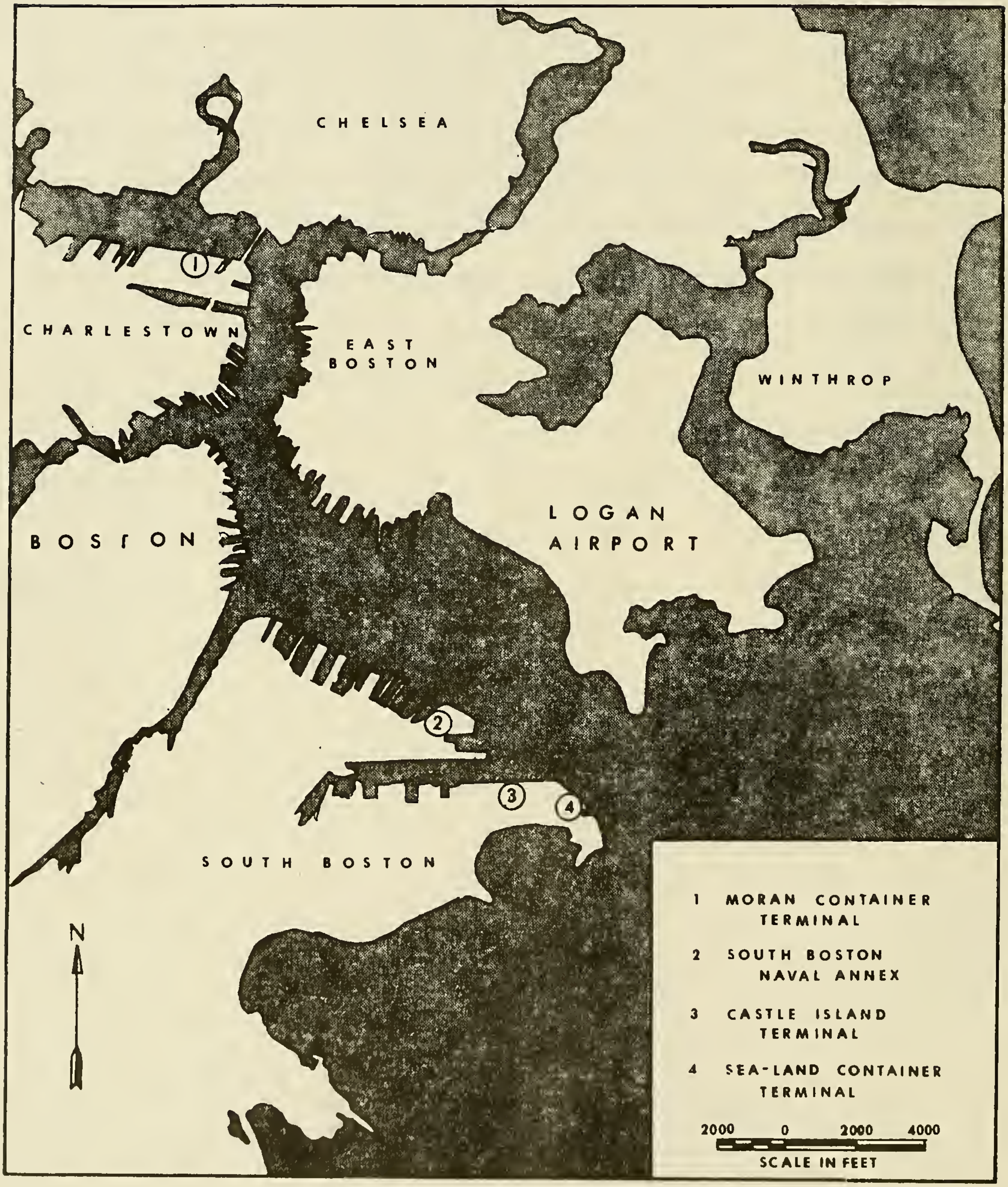
THE PORT OF BOSTON



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EXECUTIVE SUMMARY

This summary presents the findings of a study on port development undertaken by a team from the Harvard University Department of City and Regional Planning for the Massachusetts Port Authority. The research focused on these areas of concern:

- predicting future demand for shipping through the Port of Boston up to the year 1990
- identifying the environmental, economic and financial implications of port development.

A list of the major findings follows:

SHIPPING PROJECTIONS

1) Cargo outflows (excluding scrap and petroleum) through the Port of Boston are predicted to stabilize and cargo inflows are predicted to increase.

Economic activity in the New England region is a major determinant of shipping demand for the Port of Boston. No significant growth is forecast for the manufacturing sector of the economy, which is the prime generator of outflows. The service sector, increasingly a source of demand for inflows, is projected to expand.

2) An increase in demand is predicted for all five types of cargo.

Three sets of projections of cargo flows were derived in the study based on different assumptions concerning the Port's ability to capture potential shipping business through management and marketing efforts. The "most likely" sets of projections is listed in Table 1.

TABLE 1

TOTAL SHIPPING DEMAND FOR THE PORT OF BOSTON*

MOST LIKELY ESTIMATES

(short tons)

CARGO TYPE	1980	1985	1990
Container	819,000	903,000	930,000
General Cargo**	726,000	873,000	962,000
Bulk	1,130,000	1,290,000	1,400,000
Neo Bulk	368,000	409,000	420,000
Liquid Bulk	33,281,000	39,812,000	45,544,000

---

* Includes shipping through all facilities, both Massport and private

** Consists of 80-85 percent iron and steel scrap

2) Projections of Massport's share of containerized shipments through Boston show a substantial increase over the current Moran Terminal volume.

Since Moran is now operating at capacity, and the terminal at Castle Island cannot absorb large cargo increases, current container handling capacity in the Port is inadequate to meet the projected demand.

3) The increased container traffic projected for 1980, 1985 and 1990 is sufficient to justify the construction of at least one additional container berth in the Port of Boston.

If the Moran Terminal is converted to another use, the construction at minimum of a new two-berth container facility is warranted. Table 2 indicates the future container demand to be satisfied by the facilities operated by Massport.

TABLE 2

PROJECTED CONTAINER TRAFFIC
THROUGH MASSPORT OWNED AND OPERATED FACILITIES
MOST LIKELY ESTIMATES
(short tons)

1976*	1980	1985	1990
458,000	669,000	753,000	780,000

---

*Massport estimate

ECONOMIC IMPACTS: EMPLOYMENT AND EXPENDITURES

1) By 1990, increased flows of containerized and non-containerized general cargo through the Port of Boston will lead to the creation of between 2,400 and 3,300 new jobs.

This estimate includes jobs in port-related activities (primary impacts) and in industries and firms indirectly linked to the port (secondary impacts).

2) New expenditures on goods and services generated by the increased

general cargo flows will amount to approximately $45 to $75 million dollars annually.

The total expenditure impact includes both primary and secondary effects.

ALTERNATE FUNDING OPTIONS FOR PORT DEVELOPMENT AND OPERATIONS

1) Federal funding for port development is very limited.

The only existing federal funding program potentially applicable to Massport's needs is offered through the Economic Development Administration (EDA). EDA grants are directed towards creating employment opportunities in areas with high unemployment and low family income. Technical assistance grants for port related activities are available from a few other federal agencies.

2) Throughout the United States, an increasing number of ports are being required to make tax payments to their local governments.

In a survey of nine ports around the country, it was found that many are required to pay a property tax or to make a payment in lieu of taxes, especially on leased land.

ENVIRONMENTAL IMPACTS OF PORT DEVELOPMENT

1) Water quality may be degraded by dredging and dredge disposal activities.

Water in the Inner Harbor is presently below state and federal standards. Of the construction and operations activities studies, dredging and dredge disposal will be the primary factor affecting water quality. Massport will be required to secure permits from the U.S. Army Corps of Engineers and the State Department of Environmental Quality for these activities.

2) Air quality will be degraded by increased truck traffic servicing the port.

Air quality in Boston presently exceeds standards for carbon monoxide and oxidants. Increased truck traffic servicing port facilities will generate the primary air pollution impact related to port development. At present, there are no state or federal regulations governing facilities that generate truck traffic.

INTRODUCTION

For many people, the Port of Boston is associated with paintings by Winslow Homer and 19th century sailing ships. To a great extent, the City of Boston owes its economic, cultural and demographic development to its access to the sea. But in recent years, the role of the port in the life of the city has declined. New technologies and new economic and environmental concerns have radically altered the nature of Boston's shipping industry. Rigorous port planning efforts are now required to successfully respond to new technologies and opportunities, and to insure the future economic viability of the port.

Until the middle of the 19th century, Boston's seaborne commerce made the city the major trade center in North America. Boston had little competition from other North Atlantic ports, and could depend on local resources for exports. But with the development of the ports of Philadelphia and New York, Boston's position became threatened. New York, in particular, was able to establish itself as the major eastern United States distribution port of call for national and foreign markets.

By 1840, Massachusetts had established a strong manufacturing economy, and the port played a crucial role in supplying fuel and raw materials to manufacturing industries. However, an expanding population consumed a large part of the locally produced goods, and by the 1850's, exports amounted to less than a third of the cargo flows through Boston's port. The erosion of Boston's export base continued through the 1900's. The trend in Boston toward shipping high-value, low-bulk products reduced the proportion of cargo available to fill outgoing ships. In addition, the port lost much of its bulk export of grain from the midwest, due to the structure of rail rates between Boston and the east coast. A shipping pattern emerged in which Boston, because of its demand for imports, became the first port of call for ships to unload cargo. Without sufficient exports available in Boston, ships proceeded to other ports to unload their remaining cargo and take on exports. Once this pattern became established, shipments which might have been handled by the Port of Boston were diverted to other ports.

The Massachusetts Port Authority was established in 1959 as an independent public agency to operate Logan International Airport, Hanscom Field, the Tobin Memorial Bridge, and the Port of Boston. This reallocation of responsibility marked the beginning of increased efforts to attract trade and provide modernization for the Port of Boston.

Massport believes there are several recent indications that the Port's potential as a contributor to the economy of Boston , the Commonwealth of Massachusetts and the New England region, is growing. An abatement of labor problems, which have plagued the port in its recent past, and growth in container traffic have already attracted new shipping lines to Boston. Moreover, it is likely that rail rate differentials between Boston and the midwest will be lowered to parity with New York rates, thus making Boston a practical alternative for midwest shippers. The planned 200-mile fishing limit may also benefit the port as well, by revitalizing New England's fishing industry. Finally, as large oil/bulk/ore carriers outgrow the St. Lawrence Seaway, they may go through the Port of Boston instead.

Increased demand and, in particular, recent growth in containerized shipping, have strained Boston's existing port facilities. The Port of Boston was the fastest growing port on the east coast in 1976. Massport believes that new facilities must be built in order to sustain growth. Therefore, the Authority has recently begun to investigate the development of a third container terminal and a roll-on/roll-off cargo facility. As part of this planning effort, Massport commissioned a team of graduate students from the Harvard University Department of City and Regional Planning to study various aspects of port development. This report is the product of its study. The approach used by the team is outlined below.

Study Design

In the first part of our study we forecast demand for expanded cargo-handling facilities. Using estimates of future economic activity in New England, we projected cargo flows through the Port of Boston up to the year 1990. A general description of the analytical approach and methodology used, as well as our recommendations for facility development, is presented in Chapter I. Appendix A explains each step of our methodology in greater detail and identifies our data sources.

In the second part of the study we examined the economic, financial environmental implications of Port development in Boston. In our economic analysis we estimated the changes in employment and income which can be expected to result from the increased tonnage flows projected in Chapter I. Chapter II explains the procedure we followed in assessing economic impacts and presents our impact estimates.

The financial portion of our study (Chapter III) consists of an investigation of alternate funding mechanisms which can be used by Massport whether or not there is facility expansion. Specifically, we determined what government funds are currently available to United States ports, and we surveyed the financial relationships which ports in different parts of the country have with their state and local governments. Neither our environmental nor our financial study were tied to specific development scenarios.

The final chapter presents the findings of our environmental study. This began with an investigation of the present air and water quality in the harbor area. Next we reviewed the likely air and water pollution effects of possible port development. Finally, we surveyed federal and state regulations governing the environmental effects of constructing and operating port facilities.

Planning for port development involves many complex factors. The need for new facilities hinges on such factors as the actions of private firms, of government bodies, and of other ports, as well as the state of the national, regional and international economies. Different assumptions about these variables will lead to different forecasts of need for port facility development. Although some factors, such as changes in transportation technology and social conditions, are difficult to predict, our analytic framework may be adapted to accomodate new information and different assumptions. Massport will be able to use this tool for policy analysis and decision-making in further port planning efforts.

CHAPTER I

DEMAND FOR PORT FACILITIES

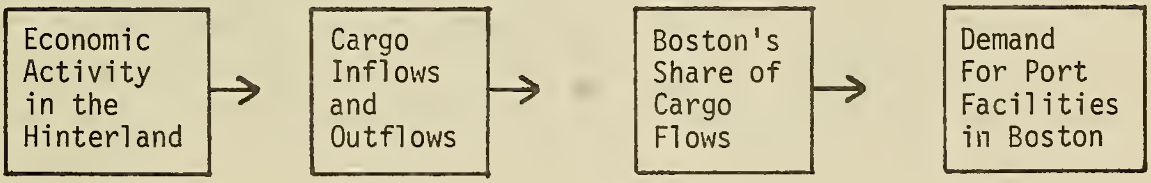
INTRODUCTION

Improvements in shipping technology and recent increases in cargo volumes passing through the Port of Boston have led Massport to consider expansion of its cargo-handling facilities. Careful planning of new facilities is necessary to insure their full and efficient utilization since port facilities are expensive to build, have a long life-span, and are not readily converted to other uses.

In this chapter we discuss our investigation of the demand for Boston's port facilities over the next 15 years. The first part of the chapter explains the analytical framework we devised to estimate demand for port facilities. It is a way of looking at the demand for ports in general, in terms of potential market areas for ports and competitive factors among ports. The second part of this chapter applies our analytical framework to the estimation of demand for the port of Boston's facilities. In the final part we discuss possible uses of the framework in port planning and operations.

ANALYTICAL FRAMEWORK

Ports provide a service to firms. They are the link in the transportation chain where cargo is transferred from a water to a land-based transportation mode and vice versa. Cargo flows through the port are generated by the economic activity - the production of goods and services - in a region. This cargo flow implies a need for a certain number and kind of port facility. Thus, the demand for port facilities is derived from the level of economic activity in the region. The diagram below outlines our approach to estimating the demand for port facilities at the port of Boston.


Economic Activity in the Hinterland
Cargo Inflows and Outflows
Boston's Share of Cargo Flows
Demand For Port Facilities in Boston

The first task in our framework is choosing an appropriate region as the basis for analysis. Ports compete with one another to attract cargo, and shippers will choose that port which minimizes their total transportation costs. One of the major components of the cost of transporting goods is inland transportation costs to or from the port. These inland transportation costs are largely a function of distance. Thus, every port has a natural region within which it possesses an inland transportation cost advantage over other ports. This region is the hinterland, or primary market area, of the port. Ports also have a secondary market area where they have an inland transportation cost parity with other ports. In projecting economic activity and future cargo flows, we focused exclusively on the primary market area because of data and time limitations.

The second task in our framework for estimating demand is projecting the level of economic activity in the port's hinterland. Firms require certain commodities in the production of goods and services. Firms also ship goods to their markets. It is important to disaggregate economic activity into various sectors, since different economic sectors generate different demands on cargo-handling facilities. For example, the manufacturing sector is the primary exporter of goods, whereas the service sector does not produce or export goods. Thus, growth in each economic sector has very different implications for port planning.

For manufacturing industries, increases in production will likely lead to increases in outflows. And as the production of goods and services in any sector increases, more commodities used in the production of those goods and services will be imported into the region. Since we wish to estimate demand for port facilities, we focus only on shipments to and from the hinterland which are transported by vessel. Vessel shipments include foreign imports, foreign exports and domestic coastwise shipping.

Not all of this shipping will go through the major port in a region. Although a port may possess an inland transportation cost advantage over other ports, there are other significant costs in shipping goods. Two additional components of total shipping costs are port costs and waterborne transportation costs. Port costs include service charges, such as wharfage and pilotage, and time costs, which reflect the port's efficiency in loading and unloading vessels. Waterborne transportation costs are largely a function of time, which changes with distance and the frequency of departures for desired destinations. A port which offers lower port costs or waterborne transportation costs may be able to attract shipping from a region in spite of higher inland transportation costs to the port.

We define a port's capture ratio as the percentage of a region's total vessel shipments which go through that port. A port's capture ratio is primarily a function of its cost competitiveness with other ports. Since there is relatively little that a port can do to lower shippers' inland transportation costs, competition between ports centers on port costs and waterborne transportation costs.

The three components of transportation costs are of differing importance to shippers of different commodities. For example, a shipper of a bulky item like machinery, which is difficult and relatively expensive to transport over land, is likely to choose the closest port with vessels to the desired destination. However, a shipper of a perishable good or a good with relatively low inland transportation costs is more likely to ship through the port which minimizes time costs.

The last step in our framework for estimating demand for port facilities is projecting the tonnage flows of different commodities through the port. These projections of tonnage flows are compared to both present flows through the port and the current capacity of port facilities, so that the possible need for additional port facilities based on increases in demand can be determined.

ESTIMATION OF DEMAND FOR THE PORT OF BOSTON'S FACILITIES

In this section we discuss the application of our analytical framework to the estimation of demand for cargo-handling facilities in the Port of Boston in 1980, 1985 and 1990. This process involved six steps:

1) Choosing a hinterland;
2) Projecting economic activity in the hinterland;
3) Estimating the cargo inflows and outflows generated by this economic activity;

4) Determining the share of the hinterland's total cargo flows going through the Port of Boston;
5) Calculating the total tonnage flows by commodity going through the Port of Boston;
6) Estimating the demand for cargo-handling facilities implied by the projected cargo flows.

The following discussion outlines our methodology and presents our findings for each of these steps. A more detailed discussion of the methodology is contained in Appendix A. It should be noted that all our calculations are based on an assumption of no capacity constraints on shipping through the port.

Choosing a Hinterland

We chose the six New England states as the hinterland for the port of Boston. Our decision was based on two factors. First, Boston is the closest major port to most areas in New England. The only exception is southern Connecticut which is closer to the port of New York. The second factor determining our choice of hinterland was the organization of the data. Most of the information necessary for forecasting demand for port facilities is collected at the state level. It was therefore not possible to define a hinterland along other than state lines.

Projecting Economic Activity in the Hinterland

We examined a number of employment forecasts for the New England States. Of these forecasts, only the National Planning Association (NPA) projected economic activity for all six New England states for 1980, 1985 and 1990, disaggregated by two-digit Standard Industrial Classification (SIC) codes (NPA, 1976). Although all the forecasts projected very similar estimates for total employment in each state, there were some discrepancies between the NPA model and the others concerning the distribution of employment among the different sectors. The NPA model projected fewer service jobs and more manufacturing jobs than the other models. We therefore adjusted the NPA projections to reflect what we felt to be the more realistic distribution predicted by the other models.[1]

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[1] A more detailed description of the differences in the projections, as well as the adjustments made, is contained in Appendix A.

The adjusted employment projections were then converted to projections of output, as measured in constant dollars, by using past ratios of output to employment and adjusting for the increasing productivity of labor. Table I-1 gives the output projections for each economic sector for 1980, 1985 and 1990.

Findings

We project output in the New England economy to increase at an average annual rate of 5.9% over the 24-year period between 1966 and 1990. However, this growth is not reflected equally in all sectors of the economy. The manufacturing sector will experience very little growth, with an average annual growth rate of less than 1%. Agriculture will decline at an annual rate of 1%, and the service sector will expand rapidly at an average yearly rate of 9% over the 24-year period.

Within the manufacturing sector, we forecast significant changes in the mix of industries. We divided the manufacturing sector into 20, two-digit SIC code industries. Of the 20, ten industries are projected to increase their output, while ten will decrease over the period. The major growth industries are paper products, instruments and chemicals; leather, textile and primary metal industries are projected to decline.

Estimating Cargo Inflows and Outflows

Foreign Exports and Imports

Several different economic sectors produce exports, including manufacturing, agriculture, and mining. In addition, a considerable amount of scrap and waste products are exported. We used different sources in forecasting the changes in each kind of export. For manufactured goods, we examined data on the output and exports of New England manufacturing sectors from the United States Bureau of the Census publication, Survey of the Origins of the Exports of Manufactured Products. We computed a ratio of exports to output for each manufacturing sector for the four years we examined - 1966, 1969, 1971 and 1972. We then calculated the average of these ratios and multiplied this average ratio by our projections of output in each sector to obtain projections of total foreign exports for each manufacturing sector.

TABLE I-1

New England Output of Goods and Services
(in millions of 1967 constant dollars)

Economic Sector	1966	1972	1980	1985	1990
Agriculture	1,129	1,018	934	906	846
Mining	65	78	138	160	199
Construction	3,682	4,631	7,119	8,673	9,793
Food and kindred	2,747	2,979	2,520	2,376	2,180
Textile	1,861	1,655	1,024	874	698
Apparel	1,716	1,167	977	979	901
Lumber	457	568	655	664	629
Furniture	338	551	447	469	451
Paper	1,681	2,096	2,375	2,667	2,753
Printing	1,383	1,666	1,652	1,741	1,712
Chemicals	1,571	1,709	2,013	2,211	2,297
Petroleum	93	103	117	126	134
Rubber	688	1,534	1,384	1,295	1,172
Leather	1,498	1,134	981	1,010	136
Stone, glass, clay	641	770	784	856	904
Primary metals	2,370	1,864	1,502	1,441	1,284
Fabricated metals	2,191	2,738	2,611	2,852	2,907
Machinery except electrical	3,827	3,707	3,243	3,416	3,319
Electrical equipment	3,494	4,111	3,286	3,448	3,300
Transportation equipment	4,043	2,649	2,699	2,660	2,484
Instruments	1,420	1,756	1,922	2,814	2,660
Miscellaneous manufacturing	1,300	1,557	1,309	1,365	1,353
Transportation, communic., utilities	4,879	7,130	12,247	14,213	15,845
Wholesale & retail trade	8,625	12,049	17,760	21,376	24,755
Finance, insurance, real estate	8,267	11,625	16,968	20,379	22,466
Services	38,099	52,107	79,040	102,820	126,810
Civilian government	915	1,313	1,787	2,037	2,310

To obtain estimates of total foreign exports by vessel, we derived ratios of foreign exports through the Port of Boston to all New England foreign exports, using U.S. Census data (Domestic and International Transportation of U.S. Foreign Trade, 1970). These ratios were applied to our projections of New England exports. The export projections were than converted to tonnages using dollar to ton conversion factors from the U.S. Census Bureau's U.S. Exports of Domestic Merchandise (1969).

Agricultural and mining exports through the Port of Boston were estimated independently from their geographic origins. This procedure was necessary because there was no regional data available on foreign exports from these sectors. We obtained data on agricultural and mining exports through the Port of Boston for the years 1966, 1969, 1971 and 1972 (U.S. Army Corps of Engineers), and then derived ratios of exports to output for each of the two sectors. We then multiplied the average of these ratios by our projections of New England output to obtain projections of agricultural and mining exports through the Port of Boston.

Scrap and waste products exported through the Port of Boston were estimated independently of their geographic origin as well. Since scrap and waste (old cars, washing machines, tin cans, etc.) are the result of New England households consuming goods rather than New England industries producing goods, we projected scrap exports as a function of personal consumption expenditures (PCE). Specifically, we used an average of past ratios of scrap and waste exports through the Port of Boston to New England PCE. We then multiplied this average ratio by projections of PCE expressed in constant dollars (New England Regional Commission, 1975), to obtain projections of scrap and waste through the Port of Boston for 1980, 1985 and 1990.

There was no data available on the import requirements of the sectors of the New England economy. We therefore used national data on the import requirements of the different sectors of economic activity and adjusted the data to reflect New England's industry mix.[2] This gave us the total import requirements in dollars for each economic sector. To determine the commodity distribution of these imports, we allocated the total dollar requirements of each sector to different commodities in proportion to the commodities' use in the production of goods and servcies in each sector.

---

[2] We used a 1963 input-output table for the United States (Survey of Current Business, 1969). Row 80 of the table, "Direct Requirements per Dollar of Gross Output", provided the import requirements for each of the 78 industries included. These were then multiplied by 1963 output for New England for each of the industries (Polenske, 1972) and then aggregated into the 28 sectors we used in our projections of economic activity.

We then adjusted our dollar estimates of imports to reflect only vessel imports (U.S. Bureau of the Census, Domestic and International Transportation of U.S. Foreign Trade, 1970), and converted these estimates from dollars to tons using the conversion factors from U.S. General Imports, Schedule A, 1968.

Domestic Coastwise Shipping

The coastwise shipping through the Port of Boston generated by economic activity in New England could not be estimated directly, given available data.[3] Therefore, we linked coastwise shipping to foreign imports and exports since in the past there has been a consistent relationship between coastwise receipts and imports (both inflows) and coastwise shipments and exports (both outflows).

We calculated past ratios of coastwise receipts to imports and coastwise shipments to exports for different commodities (U.S. Army Corps of Engineers, Waterborne Commerce, 1971, 1972, 1973, 1974). We then multiplied the average of these ratios by our projections of foreign imports and exports through the port of Boston to obtain estimates of projected coastwise shipping.

Findings

We project that New England manufacturing exports will stay relatively stable over the 1966 - 1990 period, with an average annual growth rate of 1.6% (see Tables I-2A and I-2B). Within the manufacturing sector, exports of food and kindred products, textiles, apparel, leather, and primary metals are expected to decline over the 24-year period, while growth is projected

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[3] There were extensive data problems in estimating coastwise shipping as a function of economic activity. It would have been necessary to examine all possible shipping choices (air, rail, truck and water) of all New England firms to calculate the percentage of total shipments through New England ports. It then would have been necessary to determine the portion New England vessel shipments going through the Port of Boston.

TABLE I-2a

New England Vessel Exports of Manufactured Products

(thousands of tons)

Commodities	1966	1972	1980	1985	1990
Food and kindred	288	344	276	260	239
Textile	30	21	15	13	10
Apparel	3	3	3	3	3
Lumber	662	824	950	963	193
Furniture	2	3	3	3	3
Paper	282	580	533	598	618
Printing	8	8	9	10	9
Chemicals	252	334	274	300	312
Rubber	33	28	35	34	31
Leather	13	13	10	10	9
Stone, glass, clay	57	44	62	68	72
Primary metals	104	132	90	87	77
Fabricated metals	69	54	66	72	74
Machinery, except electrical	118	142	154	163	158
Electrical equipment	45	64	64	67	64
Transportation equipment	87	198	185	182	170
Instruments	20	28	35	42	48

TABLE 1-2b

New England Vessel Imports

(in thousands of tons)

Commodities	1966	1972	1980	1985	1990
Agriculture	360	377	342	336	322
Mining	7,066	7,463	8,826	9,806	10,413
Food and kindred	411	451	480	529	567
Textiles	89	87	68	66	60
Apparel	22	23	22	24	25
Lumber	329	402	502	574	616
Furniture	5	5	6	7	7
Paper	551	674	781	889	966
Printing	306	411	601	766	929
Chemicals	703	863	1,089	1,307	1,499
Petroleum	2,395	3,139	4,617	5,534	6,340
Rubber	121	134	150	170	183
Leather	18	14	12	13	13
Stone, glass, clay	247	296	366	425	466
Primary metals	367	365	349	372	371
Fabricated metals	170	190	212	238	252
Machinery, except electrical	37	36	37	40	41
Electrical equipment	32	35	40	42	44
Transportation equipment	48	43	50	54	56
Instruments	7	9	13	16	19
Miscellaneous manufacturing	9	11	12	15	17

in such industries as paper and chemicals. These projections reflect trends in economic activity, with high growth industries exhibiting the highest growth in exports. The most significant export from New England is lumber, which composes 30% of all export tonnage in 1990. Other major exports are food and kindred products, paper products and chemicals. In fact, these four commodities are expected to comprise 73% of all New England manufactured exports in 1990.

We project that foreign waterborne imports generated by the New England region will increase steadily, with a 3.1% average annual growth rate forecast between 1966 and 1990. However, there will be significant changes in the commodity mix of imports. Petroleum products, for example, will grow 6.87% a year, over double the average import rate. As a result, petroleum shifts in importance as an import from 18% of all imports in 1966 to 27% in 1990. In contrast, we forecast declines in the imports of leather and textiles. These changes in the commodity mix of imports reflect the shifting industry composition forecast for New England. Imports of commodities which are used by all industries, such as petroleum, will increase as total production of goods and services in New England rises. Imports of commodities which are used by a few declining industries, such as leather and hides, will decrease.

Determining the Port of Boston's Share of New England Vessel Imports and Exports

We computed capture ratios i.e., the proportion of the vessel imports and exports generated by New England that will be shipped via the Port of Boston, for different commodities for 1966, 1969, 1971 and 1972 (Waterborne Commerce). Based upon this data, we then made three projections of capture ratios for each of our three forecast years, 1980, 1985 and 1990. The three projections represent low, most likely and high estimates of the proportion of containerized inflows and outflows captured by the Port of Boston.

Our low estimates are based on the average of the capture ratios for 1966, 1969, 1971 and 1972. We believe they understate future capture because they do not take into account any of the recent improvements in service and marketing made at the Port of Boston. The most likely capture ratio estimates take into account these more recent trends. They project a 25% increase in capture of imports and a 60% increast in capture of exports. High capture ratio estimates were made using more optimistic assumptions about the ability of the Port of Boston to improve its capture of containerized commodities. The high estimates assume a 60% increase in import capture and a 250% increase in export capture.

Findings

Our projections, summarized in Table I-3, indicate that the capture ratio for imports is higher than exports for almost every commodity. This discrepancy reflects the different characteristics of New England exports and imports. Most of the tonnage imported through the Port of Boston has been crude petroleum, limestone, salt, sugar, kerosene and residual fuel oil. All of these commodities are bulk goods which are difficult and expensive to transfer over land. Thus, Boston captures much of this type of cargo destined for New England markets. However, exports through the Port of Boston tend to be finished, high-value products with relatively lower land transport costs. Boston captures relatively little of this traffic from New England firms. In fact, the overwhelming percentage of export tonnage through the Port of Boston is scrap and waste products which are also bulky items.[4]

Calculating Tonnage Flows by Commodity Through the Port of Boston

We multiplied our low, most likely, and high estimates of Boston's capture ratio by our projections of New England imports and exports. We then adjusted these projections of foreign imports and exports to account for coastwise receipts and shipments using the ratio from past years. This gave us projections of tonnage inflows and outflows through the Port of

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[4] That the capture ratio is greater than one for certain commodities is a result of our method of estimating total New England imports. We used the distribution of commodities imported through both New York City and Boston to reflect the distribution of imports into New England. This introduces a bias for certain items which result in Boston's having a capture ratio greater than one. A more complete discussion of this bias is in Appendix A.

TABLE I-3

Capture Ratios for Port of Boston

(Port of Boston Foreign Exports and Imports as a Percent of Total New England)

	Foreign Imports			Foreign Exports		
Commodity	Low	Most Likely	High	Low	Most Likely	High
Food & Kindred Prods.	1.37	1.37	1.37	.17	.206	.263
Textiles	.38	.47	.59	.09	.142	.228
Apparel	.09	.12	.15	.016	.025	.04
Lumber	.30	.33	.39	.001	.001	.001
Furniture	.61	.77	.96	.034	.054	.087
Paper	.06	.08	.12	.031	.05	.079
Printing	.002	.003	.003	.05	.08	.128
Chemicals	.05	.05	.06	.03	.048	.077
Rubber	.04	.05	.06	.028	.045	.072
Leather	2.08	2.08	2.08	.59	1.0	1.0
Stone	.13	.13	.13	.03	.048	.077
Primary Metals	.49	.51	.53	.015	.024	.038
Fabricated Metals	.18	.23	.29	.021	.034	.054
Machinery except Elect.	.46	.58	.73	.042	.067	.107
Electrical Equipment	.23	.29	.36	.026	.042	.066
Transportation Equip.	1.06	1.06	1.06	.003	.005	.003
Instruments	.09	.12	.15	.047	.075	.12
Misc. Manufacturing	1.36	1.36	1.36			
Agriculture	.21	.22	.23			
Mining	.06	.06	.06			
Petroleum	2.19	2.19	2.19			

* Data was not available to create capture ratios on these commodities for foreign exports. Tonnages through the port were assumed to increase 10% for most likely capture and 20% for high capture (over the low capture ratio).

Boston for each commodity.

Findings

We project an increase in both total outflows and inflows through the Port of Boston through 1990 (see Table I-4). Although foreign exports are declining, we project an increase in total outflows (foreign exports plus outward-bound coastwise shipments) of 3.4% per year. Over 99% of this increase is explained by growth in the exports of iron and steel scrap and in the coastwise shipment of petroleum. Both of these outflows are linked directly to population and income, rather than production, with population and income projected to increase in New England through 1990. In addition, the petroleum outflows, the largest portion of the increase, reflect a rise in coastwise shipments of imported foreign petroleum, arriving in Boston and then departing to other New England ports.

Assuming our most likely capture ratio, the annual growth rate of inflows over the ten year period from 1980 to 1990 is projected to be 3.4%. 92% of this increase is explained by increases in imports of petroleum products. Petroleum is by far the largest commodity, by weight, entering the port. Because of this dominance it can mask trends in other commodities. Therefore, we disaggregated the total projections and examined the trends of individual commodities. Almost all commodities show some increase in inflows over the ten year period.

In summary, outside of petroleum and scrap, we project a stabilization in outflows through the Port of Boston and outside of petroleum we project a modest increase in inflows through the port from 1980 - 1990.

Estimating the Demand for Port Facilities

We converted the tonnage projections of commodities into projections of cargo types. These cargo types correspond to the kinds of port facilities required for cargo handling. We classified commodities into one of five types of cargo:

General Cargo -- including iron and steel scrap and agricultural products;
Bulk -- primarily mining and stone producst;

TABLE I-4

Inflows and Outflows through Port of Boston

(in tons)

	Inflows			Outflows		
Commodities	Low	Most Likely	High	Low	Most Likely	High
1980						
Agriculture	77,100	81,000	84,700	20,000	22,100	24,100
Mining	565,000	565,000	565,000	10,300	11,400	12,400
Durable Mfg.	1,143,300	1,193,900	1,266,100	47,600	64,800	90,900
Nondur. Mfg.	961,600	998,200	1,055,400	117,400	163,600	227,900
Petroleum	30,360,500	30,360,500	30,360,500	2,165,900	2,166,200	2,166,500
Scrap	9,700	9,700	9,700	686,000	686,000	686,000
1985						
Agriculture	76,000	79,800	83,500	19,500	21,500	23,400
Mining	628,000	628,000	628,000	12,000	13,200	14,400
Durable Mfg.	1,306,200	1,353,400	1,434,700	50,000	68,300	95,600
Nondur. Mfg.	1,070,800	1,110,700	1,175,400	118,200	166,400	233,600
Petroleum	36,390,800	36,390,800	36,390,800	2,595,600	2,596,000	2,596,400
Scrap	8,300	8,300	8,300	840,300	840,300	840,300
1990						
Agriculture	72,800	76,400	79,900	18,200	20,000	21,900
Mining	666,000	666,000	666,000	15,000	16,400	17,900
Durable Mfg.	1,390,600	1,447,900	1,533,000	49,300	67,400	94,500
Nondur. Mfg.	1,152,900	1,197,300	1,272,800	113,700	161,100	221,400
Petroleum	41,691,300	41,691,300	41,691,300	2,973,400	2,973,800	2,974,200
Scrap	6,600	6,600	6,600	930,200	930,200	930,200

Liquid bulk -- sugar, petroleum, etc.;
Neo-bulk -- wood and metal products, motor vehicles;
Container -- all other goods.

A detailed classification of commodities by cargo type is contained in Appendix B. The assignments of commodities to cargo types are based upon the nature of the commodities. Except for a few specific commodities, which are handled by bulk, liquid bulk and neo-bulk facilities, all other commodities are general cargo. All general cargo that is containerizable (Temple, Barker, Sloane, 1976) is assumed to be containerized by 1980.

In estimating the demand for port facilities we focused exclusively on the demand for container facilities, since most of the facilities for handling bulk commodities are privately owned and operated. We examined the current utilization of both the Moran and Castle Island terminals to determine a base line of existing container handling capacity. We then compared this base line capacity to our projections of increased container cargo to determine whether the increases in demand for container handling facilities justified the construction of additional container facilities.

Findings

As Table I-5 indicates, we project an increase in all five types of cargo under all three estimates of capture ratio. The most likely projections indicate that between 1976 and 1980, the Massport container volume will increase by about 211,000 tons (see Table I-6). By 1985, the increment over current volume should be about 295,000 tons and by 1990, about 332,000 tons.

Comparing this increase to present container-handling capacity in the Port indicates that substantial increases in tonnage cannot be accomodated by current facilities. The capacity of Sea-Land's facility at Castle Island is limited because the crane is too low, due to its location with respect to flight paths at Logan Airport, and too small to service much of the modern container traffic. Thus, we assume the Sea-land facility will not be available to absorb a significant increase in tonnage.

TABLE I-5

Summary Sheet
Cargo Projections (tons)

		1980	1985	1990
Container	low	696,700	744,800	797,100
	most likely	818,800	903,000	930,200
	high	994,300	1,093,800	1,127,900
Non-Containerized General Cargo*	low	720,400	871,500	957,000
	most likely	725,900	873,400	962,000
	high	732,600	883,300	968,100
Bulk	low	1,124,800	1,284,700	1,393,800
	most likely	1,129,300	1,290,000	1,399,800
	high	1,132,000	1,293,800	1,403,200
Neo Bulk	low	344,400	382,900	392,300
	most likely	367,900	409,000	419,700
	high	409,700	456,000	469,200
Liquid Bulk	low	33,279,400	39,810,700	45,541,900
	most likely	33,280,800	39,812,400	45,543,700
	high	33,282,900	39,814,900	45,545,500

*Consists of from 80 to 85 percent iron and steel scrap.

TABLE I-6

Projected Increase in Massport Container Tonnage

	1980	1985	1990
Low	88,700	136,800	189,100
Most Likely	210,800	295,000	322,200
High	386,300	485,800	519,900

In 1976, the Moran terminal operated at capacity.[5] There are a number of considerations which determine the optimal capacity of a container facility. Some of these factors are site specific and depend upon the equipment, location and layout of the facility. Others depend upon the schedules of vessels using the facility.[6] Acreage for container marshalling is among the most important variable affecting the effeciency of a "standard" two crane per berth facility (AAPA, 1973). Moran's limited acreage thus makes its effeciency less than optimal and its capacity somewhat below the 600,000 ton minimum. In addition, the AAPA indicates that for efficient scheduling of ships, the ideal berth utilization rate (percent of days per week) is 30%. Massport reports that Moran's utilization rate is 60%, reflecting a state of congestion and lack of flexibility in scheduling. Any increase in container tonnage would place a further strain on the operations at Moran (see Table I-6).

We conclude that our projected increases in the shipping of container commodities cannot be handled by present facilities. The tonnage forecasts justify the construction of at least one additional one-berth facility if the Moran terminal continues in operation. However, as we indicated, there is evidence of serious innefficiences at Moran. An alternative proposal would be to consolidate all Massport container facilities at one location and convert Moran to an alternative use. If this were done, then the projected increases in demand would justify construction of at least a two-berth container facility.

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[5] According to estimates by the American Association of Port Authorities (AAPA, 1973), the optimal cargo volume for "practical" operation of a one-berth, two crane container facility (like Moran) of 50 acres and 900 feet of dock is between 600,000 and 900,000 tons per year. This volume permits the most efficient utilization of the facility. Moran, with 1,000 feet of dock but only 29 acres handled about 458,000 container tons in 1976.

[6] A report prepared for the Maritime Administration (Manalytics, 1976) divides these factors into two categories, "terminal capacity elements" and "terminal activities". Terminal capacity elements include types of equipment, storage capacity, work hours and person-days, berth utilization, peaking, and truck access. Terminal activities include ship-apron transfer, apron-container storage transfer, truck entrances and exits, and cargo customs inspection.

Application of the Framework to Port Planning & Operation

This chapter of our report has emphasized that the demand for port facilities in a region is primarily determined by the level of economic activity in that region. Furthermore, the amount of shipping through any one port is determined by its competitive position relative to other ports, both inside and outside the region. The two major variables in our analytical framework are the level of economic activity in the port's hinterland and the port's ability to capture the shipping generated by that activity. The value of this approach is that it allows Massport to obtain different estimates of port shipping by varying assumptions about these two variables.

Different assumptions can be made about the appropriate level of economic activity. For example, the size of Boston's hinterland could be effectively expanded by the equalization of rail rates between Boston and the Midwest, or new data could become available about trends in the New England economy. This new information could easily be incorporated in our analytical framework resulting in new estimates of demand for facilities. The Port could also use the framework to ask a number of "what-if" questions, i.e. "What if rail rates were equalized?" "What if servicing for particular goods were improved?" and then gauge the impact of these changes on port operations. Thus, it would be possible to obtain estimates of the impact which actions by Massport would have on port operations.

Our analysis of capture ratio may also be used in marketing efforts. By continuing to estimate its capture ratio using our conceptual model, Massport can determine whether its capture of a certain commodity has been increasing or decreasing over time. It can also identify what percentage of the market it is capturing in both declining and growing industries and target its marketing efforts accordingly.

A study of the changes in capture ratio over time can also enable Massport to assess the success of its efforts to improve service or marketing because the model distinguishes between "natural growth" in the use of facilities, i.e. increases resulting from growth in the New England economy, and "marketing growth", i.e. increases resulting from the port's improved capture of particular markets. Thus, in addition to being a predictive tool, the demand framework is an evaluative device that enables the Port to identify the sources of demand for port facilities, the areas in which Boston is strong and weak, and the sectors which show the greatest potential for increased capture.

CHAPTER II

ECONOMIC IMPACTS

Port activity in Boston generates jobs and income in Massachusetts. Future increases in cargo tonnage will stimulate firms directly serving the port and produce ripple effects in other sectors of the state's economy. In this chapter, we discuss our estimates of the income and employment impacts of increased tonnage through the port of Boston. The economic impact calculations are based on our "most likely" general cargo tonnage estimates for 1980 and 1990.

Our estimates do not take into account the economic impacts of constructing the new facilities which may be needed to handle the increases in cargo. This study used the flow of cargo, rather than the operation of specific facilities, as the basis for forecasting economic impact.

DEFINITIONS

Primary Impacts

Primary economic impacts to firms are the income and employment directly associated with increases in cargo movement through the port. Income is the flow of dollars into the local economy, and employment is the number of jobs created or lost. The principal activities which generate primary impacts are ship services, services to crew members, cargo loading and unloading, surface transportation (trucking), insurance and banking, and port related government activities.

The size of primary impacts is highly dependent on the types of cargo moving through the Port. For example, because more labor is required to handle a ton of general non-containerized cargo than a ton of bulk cargo, non-containerized general cargo has a larger economic impact per ton than bulk.

Secondary Impacts

There are two types of secondary impacts, indirect and induced. Indirect impacts result from primary impacts. For example, increased cargo flows through the port have the direct effect of increasing local activity in truck operating, servicing, and maintenance firms. The indirect impact begins when these firms purchase more petroleum, repair parts, paint, etc. Then, in a further round of effects, the local paint firm, for example, purchases more solvents and pigments. The indirect impact is the sum of those increases in income and employment which accrue to local firms as a result of the chain reaction of inter-industry purchases.

Induced impacts are changes in income and employment due to changes in consumer spending. For example, longshoremen who earn additional income as a result of the increased movement of cargo will consume more goods and services from a wide variety of firms. To meet this increased demand, these firms will increase their output by increasing their expenditures and hiring more workers, who will consume additional goods and services, and so on. The sum of these consumer-induced increases in income and employment is the induced impact.

Multipliers

Multipliers are used to estimate the magnitude of the secondary impacts on the local economy. A multiplier is the ratio of the total impact (primary plus secondary) to the primary impact. The size and characteristics of the local or regional economy determine the extent to which income is used to purchase goods and services produced within that economy. Regions with relatively self-sufficient economies have large regional multipliers because less income leaves the region to purchase goods. Economics such as New England's, which rely on other regions of the country for many of their raw materials and manufactured goods, have smaller multipliers.

METHODS AND RESULTS

We used the following method to estimate the income and employment impacts of increased cargo tonnage:

1) calculate the increase in cargo tonnage by type of cargo in 1980 and 1990 using 1976 as the base year.
2) Apply ratios of the direct employment and income per ton for each type of cargo to obtain estimates of primary impact.
3) Apply a regional multiplier to the primary impact of each cargo type to estimate the total (primary plus secondary) impact.[1]

Income Impacts

The increase in cargo tonnage by 1980 and 1990 is the difference between 1976 levels and the 1980 and 1990 "most likely" projections. The cargo tonnage figures were disaggregated into two categories, containerized and non-containerized general cargo.[2] The cargo tonnage increases were multiplied by dollar impact per ton factors obtained from other port studies. The high and low factors shown in table II-1 provide a range of primary income impacts.[3]

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[1] Employment in the port is a function of many factors, such as work rules, the level of technology, and the capacity constraints of port facilities. Due to data limitations, we have forecasted employment using projected cargo tonnage as the only independent variable.

[2] Non-containerized general cargo includes neo bulk and iron and steel scrap.

[3] The income impact per ton figures used for the low impact estimates were obtained from a study of the port of Montreal (1971) and the high estimates from a study of the port of Baltimore (1975). Both figures were inflated to 1976 dollars.

TABLE II-1

Dollar Impact Per Ton Factors (1976 dollars)

Type of Cargo	($/short ton) LOW	HIGH
Containerized	$19	$27
General Non-Containerized	41	56

Primary impacts were then multiplied by the high and low income multipliers shown in table II.[4]

TABLE II-2

Employment and Income Multipliers

	LOW	HIGH
Income	1.7	2.0
Employment	1.8	2.5

It is important to note the difference between annual and cumulative income impacts. To illustrate, annual income impact by 1980 is the difference between annual income in 1976, the base year, and 1980. Cumulative impact is the sum of the annual impacts from 1976 to 1980. Table II-3 shows the projections of primary annual and cumulative income impacts.

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[4] The source of the low income and employment multiplier is the Quincy Fore River Bridge Study. It can be considered low because the project involved a relatively small region and large expenditures for goods manufactured outside of New England. The Baltimore port study provided the high multipliers. Baltimore has more of a manufacturing-based economy than Boston, and it is very unlikely that Boston's secondary impacts could approach those of Baltimore.

TABLE II-3

Primary Income Impacts in 1980 and 1990, Cumulative and Annual

(millions of 1976 constant dollars)

ANNUAL

	1980		1990	
	low	high	low	high
Container	3.9	5.5	6.0	8.6
Non-cont.	8.7	11.9	20.5	28.1
Total	12.6	17.4	26.5	36.7

CUMULATIVE

	1980		1990	
	low	high	low	high
Container	9.7	13.9	63.0	89.6
Non-cont.	21.9	29.9	183.3	250.5
Total	31.6	43.8	246.3	340.1

By 1980, the primary impact from increased general cargo (including iron and steel scrap, lumber, and autos) over 1976 levels is estimated to be between $12 and $17 million annually, for a cumulative impact of between $31 to $44 million. By 1990, the annual primary impact will increase to between $26 and $37 million per year, resulting in a cumulative impact of between $250 and $340 million. Please note that most of the impact is generated by non-containerized general cargo (largely iron and steel scrap), and that using 1976 as the base year causes the cumulative impact projected for 1990 (26 years later) to be quite large.

The final calculation is an estimate of the total income impact of the projected increase in cargo. The entire calculation can be summarized as follows:

additional tonnage x primary impact/ton x multiplier = total impact

Table II-4 shows the total income impact, both annual and cumulative.

TABLE II-4

Total Income Impacts (primary & secondary) in 1980 and 1990, Cumulative and Total (millions of 1976 constant dollars)

ANNUAL

	1980				1990			
Multipliers:	1.7		2.0		1.7		2.0	
	low	high	low	high	low	high	low	high
Container	6.6	9.3	7.8	11.0	10.2	14.5	12.0	17.1
Non-cont.	14.8	20.2	17.4	23.8	34.9	47.7	41.1	56.1
Total	21.4	29.5	25.2	34.8	45.1	62.2	53.1	73.2
CUMULATIVE								
Container	16.5	23.6	19.4	27.8	107.1	152.3	126.0	179.2
Non-cont.	37.2	50.8	43.8	59.8	311.6	425.8	366.6	501.0
Total	53.7	74.4	63.2	87.6	418.7	578.1	492.6	680.2

By 1980, secondary effects raise the total annual impact to between $21 and $35 million, and cumulative impact to between $54 and $87 million. Ten years later, the total annual impact will range from $45 to $73 million, with a cumulative impact of between $420 and $680 million.

Employment Impacts

The method of estimating employment impacts was similar to that for income impacts, except that limitations in our data made it necessary to combine containerized and non-containerized general cargo into one category. We used a ratio of 163 employees to every 100,000 tons of general cargo to project the primary employment impact for 1980 and 1990.[5] The employment impact for 1980 and 1990 is the number of jobs created from 1976 to 1980 and 1990, repectively. It is assumed that Massachusetts will continue to experience moderate unemployment, expecially for semi-skilled workers, and that the majority of jobs created in the port will be blue-collar and clerical. Therefore, the new jobs resulting from port activity will in fact be additions to the economy rather than transfers from other sectors.

If facilities capable of handling the projected increases in general cargo are available, approximately 700 port-related jobs will be created by 1980, and 1300 by 1990. Using high and low mulipliers of 2.5 and 1.8 respectively, the total employment impact (primary plus secondary) will be between 1000 and 1700 jobs in 1980 and between 2400 and 3300 jobs in 1990.

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[5] A study of the Port of Seattle (1974) provided the basis for the employment per ton ratio. We used the definition of direct employment stated earlier in this chapter to modify the employment figures from Seattle. Of the ports reviewed, Seattle was the only one which disaggregated employment by cargo type. The ratios between containerized and non-containerized general cargo in Boston and Seattle are not very dissimilar (in 1974), although they can be expected to change over time.

CHAPTER III

FINANCIAL STUDY

INTRODUCTION

A major consideration in planning for the Port of Boston's future is the financing of port development, maintenance, and operations. In this chapter of our study we review two areas of port finance: 1) government funds and technical assistance currently available to ports, and 2) the financial arrangements other United States ports have with their state and local governments. Information on government assistance was gleaned from a survey of government publications and from interviews with government officials. Information on port-government finance was developed from a survey we conducted of eight U.S. ports. Before discussing our findings, we will briefly describe current Massport finances.

Current Massport Finances

Massport is a financially independent public authority. It does not receive government tax monies, nor can it pledge the state's or city's credit. Funds for port development come from the sale of revenue bonds, and income for operations is generated by tolls on the Tobin Memorial Bridge, rental and user fees, concessions at Logan Airport, and interest from investments. Massport has no shareholders or equity-holders.

In the past, Massport has been a profitable venture, and the Authority has had little trouble floating new bond issues. However, port bond issues are facing increasing competition in the bond market, as a growing number of governmental organizations are issuing bonds to finance new projects (Casey, 1974). Since Massport is dependent on private investment for future growth, it is essential that it remain on a firm financial basis and maintain its present position in the bond market.

Moreover, while Massport facilities are collectively self-sustaining, individually they are not. Logan Airport and the Tobin Memorial

Bridge continue to generate surpluses, but the port has operated at a deficit for the past six years. In 1975, maritime operations, including maintenance and debt service, generated a loss of $1.7 million (Massport, A Study Guide to Massport Financials).

The port of Boston is not unique in its financial difficulties. Throughout the United States, seaport operations generate minimal profits. In a survey of 31 ports conducted in 1971, the American Association of Port Authorities found that the average port realized a net return on its investment, before debt service, of only four percent. This rate was reduced to one percent after satisfying debt obligations. These averages mask regional differences among ports; the study found that ports in the southern states showed returns of less than two percent after debt service, whereas those in the northern states were operating at deficits of up to two percent (U. S. Department of Commerce, 1974).

FEDERAL AID TO PORTS

In an effort to find means for reducing the burden to Massport caused by port deficits, we conducted an investigation of government assistance currently available to ports. We found that neither the Commonwealth of Massachusetts nor the City of Boston has the fiscal capacity to provide any funds to the port of Boston in the foreseeable future. While some federal support was found to be available, it is very limited.

Port Financing Policy

In the past, the Port of Boston, like other ports in the United States, has chosen to function through local support and control. The federal role in the development and operation of United States port facilities has generally been limited to the provision of waterways and navigational aids, and to regulation of the environment, public health and safety, cargo and port security, and tariffs.

Port resistance to federal aid has been motivated by the fear that federal aid would be accompanied by federal interference and control of port planning and functions, and would destroy the competitive structure of the port industry. This fear is not merely speculative. There is evidence that federal interest in participating in port planning and development is growing, in accordance with the belief that selective port development according to a national plan is more in the country's interest than the present uncoordinated structure of the port industry (Tobin, 1974). This viewpoint was expressed by former Secretary of Transportation William T. Coleman, Jr., in the following statement:

> Recent technical developments in ocean shipping have had a major, if not revolutionary, impact on the industry and will affect its economy and organization in profound ways. Foremost of these has been the growth of unitized cargo systems...It appears most unlikely that all U. S. ports now preparing for container services will prove economically viable. On the contrary, it is more probable that the economies of scale permitted by the new technology can be realized only by concentrating container terminals at fewer locations. We must develop policies which will permit these choices to be made in the national interest. A second major innovation has been the supertanker...New deepwater off-loading facilities...will be required. Such facilities, exposed to the open sea, present a variety of structural and operational challenges and will require stringent standards and regulation if the ocean and coastal environment is to be preserved...The above developments may require a more active Federal role in port development planning...Despite efforts by a number of governments to find a better substitute, the market mechanism still appears to be the best device for resource allocation. However, achieving workable competition in international transportation will require a tremendous effort in modifying the present environment (U. S. Department of Transportation, 1975).

In spite of its apprehensions, in the early 1970's the port industry took some important steps towards obtaining federal aid. At the Annual Convention of the American Association of Port Authorities (AAPA) in 1972, port representatives voted to rescind the Association's long-standing resolution opposing federal subsidies. However, the Association passed another resolution which reaffirmed its opposition to federal control (Tobin, 1974). In 1973, the AAPA encouraged federal aid through two resolutions. One urged federal funding assistance for socially desirable, non-revenue-producing endeavors mandated by the federal government (e.g., pollution control devices). The other requested federal financial assistance for modernization and expansion of port facilities, and urged a study to determine suitable sources and equitable distribution of federal assistance. These two resolutions were reaffirmed at the AAPA's 1974 meeting (National Academy of Science, 1976).

Recently, port representatives in the AAPA who are opposed to federal aid have asserted themselves more strongly than those favoring it. Therefore the AAPA has reverted back to its earlier opposition to federal subsidies. In 1975 the Association dropped both the resolutions calling for a study of the need for federal aid and the resolution requesting federal funds for port capital improvement projects. Its request for federal aid was limited to funds for federally mandated projects. This position was reaffirmed in 1976 (Schultz, 1977).

Ports are not against aid, but do oppose intervention. According to a study conducted by the United States Department of Commerce's Maritime Administration in 1974, there are several basic criteria governing the manner in which ports would consider financial aid from the federal government:

1. Local participation and decision (with due regard for the national interest);
2. Assistance available without discrimination or disruption of competitive relationships between ports;
3. Incentive funding to encourage financial involvement by beneficiaries;
4. Development grants separate from research and development efforts serving the purpose of the Departments of Commerce, Transportation, Defense, Treasury, Labor, et. al.

Sources of Federal Aid to Ports

The one existing federal program for providing funds to commercial port and marine terminal facilities meets the above criteria. This is the Economic Development Administration's (EDA) program for public works and development facilities. The objective of the EDA program is to create employment opportunities in areas with high rates of unemployment and low family income by developing or expanding facilities and resources.

The EDA program includes the following types of assistance:

1. Direct grants up to 50 percent of total project cost;
2. Combined direct and supplementary grants up to 80 percent of total project cost;
3. Loans up to 100 percent of costs for public works and development facilities, and loans up to 65 percent of costs for industrial and commercial expansion;
4. Guarantees of up to 90 percent of working capital loans;
5. Loans and grants to redevelopment areas and centers in multi-county development districts;
6. Technical and planning assistance to multi-state regional planning commissions;
7. Technical assistance and research.

Many U. S. ports, including some that have opposed federal aid in the past, have expressed an interest in obtaining EDA funds because they are the only direct access ports have to federal funds (if the ports are in designated economic distress areas) and because the EDA funds are not seen as a threat to competition among U. S. ports (Ler, 1976). The value of port and port-related projects funded by the EDA has exceeded $100 million since 1965 (U. S. Department of Commerce, 1974).

Massport has never applied for EDA support. It is difficult to predict the likelihood of acceptance of future funding applications. Two ports similar to Boston, however, have been granted funds. An application from the Port of Philadelphia has recently been approved, and the Port of Oakland has already built a container facility with EDA funds.

It appears that no other major source of federal monies will be available to U. S. ports in the foreseeable future, because of port reluctance to accept conditions tied to these funds. This dilemma is exemplified in recent congressional attempts to provide port funding. Five identical bills were introduced in the U. S. House of Representatives in the 94th Congress. H.R. 4964 was the most recent (see Appendix C). This bill would have provided grants of federal money for costs incurred in meeting federal requirements relating to environmental protection, public health and safety, and port and cargo security. Hearings were held on June 30, 1976, and the proposal was dropped because of a lack of port industry consensus supporting the bill. The ports opposed the bill because of a second provision it contained, calling for:

> a comprehensive study to determine the immediate and long-range requirements of public ports in the U. S., for expansion and modernization in order to meet adequately the economic and defense needs of the United States, and to meet such standards as may be imposed by law for purposes of environmental protection and port safety and security. Such study shall also include a comprehensive evaluation and analysis of the amount and kinds of funding which public ports have available to them for purposes of implementing current and projected expansion, modernization and other improvements.

In addition to the EDA capital investment grants, a limited number of other federal agencies offer potential financial and technical assistance. Rather than being directed primarily to port financial aid, these programs are keyed toward other purposes, such as channel improvements and maintenance, navigational aids, cargo security, and merchant marine promotion. Still, such programs benefit total port finances by releasing for other uses port funds that would have been used for the above purposes. A summary of each of these programs as described in the 1976 Catalog of Federal Domestic Assistance follows:

11.501* Development and Promotion of Ports and Intermodal Transportation

Federal Agency:

Maritime Administration, Department of Commerce

Objectives:

To promote and plan for the development and utilization of ports and port facilities, and intermodal transportation; to provide technical advice to government agencies, private industry, and state and municipal governments; and to plan for the utilization and control of ports and port facilities under national mobilization conditions.

Types of Assistance:

Advisory services and counseling; dissemination of technical information

Uses and Use Restrictions:

Federal personnel are used to advise and consult with port authorities.

12.109 Snagging and Clearing for Navigation

Federal Agency:

Office of the Chief of Engineers, Department of Army, Department of Defense.

Objectives:

To improve channels for purposes of navigation.

Types of Assistance:

Provision of specialized services.

Uses and Use Restrictions:

Each project selected must be engineeringly feasible, complete within itself, and economically justified. The non-federal interest involved must provide all land, easements, and rights-of-way for construction of the project, and bear the costs of necessary annual maintenance until such time as the location may become a part of a specifically authorized project.

17.100 Labor-Management Relations Services

Federal Agency:

Labor - Management Services Administration, Department of Labor.

Objectives:

To provide assistance in developing sound labor-management relations; resolving labor-management problems.

Types of Assistance:

Advisory services and counseling.

Uses and Use Restrictions:

Providing consultation service; aiding parties to resolve problems which will improve labor-management relations; conducting studies and analysis of specific labor-management problems; issuing guideline materials.

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[*] The numbers in each heading correspond to the program number in the 1976 Catalog of Federal Domestic Assistance.

ALTERNATIVE PORT RELATIONSHIPS WITH STATE AND LOCAL GOVERNMENTS

Increasing demands on Massport's financial resources raise the question not only of sources of public funds, but of a reassessment of Massport's financial relationships with the State of Massachusetts and the City of Boston. This issue includes ways in which these governments directly or indirectly subsidize port facilities, and payments which the port makes to Boston. The need for such a reassessment is underlined by a proposal now before the Massachusetts Senate to tax all of Massport's commercial properties. At present, commercial properties on original Massport land are tax-exempt. If this proposal is enacted, Massport itself will have to pay about $2.5 million under 50 percent valuation and $5 million under 100 percent valuation (Massport, A Study Guide to Massport Financials).

As an initial step in the reassessment process, we contacted eight port agencies in different parts of the United States to investigate their financial relationships with local government. The ports surveyed were Baltimore, Houston, Long Beach, Milwaukee, New York/New Jersey, New Orleans, Oakland and Seattle. The purpose of the survey was to determine the nature of the services different ports receive from their state and city governments and the payments they render to government. Table III-1 summarizes the results of our survey. A detailed description of our findings follows.

Local Taxes on Port Properties

Many ports are operated by special-purpose authorities which enjoy tax-exempt status as a provision of their enabling legislation. However, for the most part, port property leased to private industry does not enjoy this benefit. Our survey revealed that with the exception of two ports, Houston and New Orleans, leased port property is taxed.

The taxing schemes in practice cover a wide range of policies. Some cities require payments in-lieu-of-taxes. Only the Port Authority of New York and New Jersey makes a payment in-lieu-of-taxes to the City

TABLE III-1

Comparison of Port Relationships with State and Local Governments

City	Type of Organization	Operations	Tax Payments to Local Government	Type of Bonds	Water & Severage Payments	Sources of Fire and Police Protection
Baltimore	State Agency	port	lessees required to make payment in-lieu-of-taxes	general obligation	yes	Port has fire equipment and watchmen; City supplements these services without charge
Houston	State Authority	port	none	general obligation (limited to Harris Co.); revenue	yes	Port has own fire boats and police; City supplements without charge
Long Beach	City Agency	port	possessary tax collected on leased properties	revenue	yes	Port has own fire boats and police
Milwaukee	City Agency	port	leased buildings taxed	general obligation	yes	Fire service provided free by City. Port has watchmen: additional police protection provided by City for a fixed fee
New Orleans	State Agency	port	none	general obligation	yes	Port has own fire boats and watchmen; City supplements without charge
New York & New Jersey	Joint State Authority	port, airports, tunnels, bridges public transit, World Trade Center	fixed payment in-lieu-of-taxes	revenue	yes	Port has own fire and police department; City supplements without charge
Oakland	City Agency	port, airport, business properties	possessary interest tax collected on leased property	revenue	yes	Port has fireboat but hires firemen from City; police protection provided free by City
Seattle	State Agency	port, airport	leased property pays tax equaling 12% of rent	revenue	yes	Port has own fire and police department; city supplements without charge

of New York on all properties it owns. The payment on each piece of land is equivalent to the taxes which were in effect at the time the property was acquired. In addition, the Port Authority makes payments to the City of New York and the State of New Jersey for land it leases. This includes all airport land in New York and some marine properties in New Jersey. The amount paid for the airport property is partially a function of revenues from operations.

The ports of Long Beach and Oakland are operated by city agencies. Since property taxes are normally not collected on public property, a special tax known as a "possessary interest tax" is levied on lessees. The term is derived from the notion that long-term tenants have a "possessary interest" in the property. The rate of this tax varies with the length of the term of the lease and is higher for longer leases. In Oakland, this tax is slightly less than the city property tax. It is collected by the county, but some of these monies are returned to the City of Oakland.

In three of the areas surveyed, the issue of taxation of previously exempt land was raised last year by local legislative bodies. In both Milwaukee and Oakland the proposals were defeated. However, in March, 1976, the state of Washington enacted a tax on all public property leased to private concerns. Of the monies collected, fifty percent is allocated back to the cities where the property is located.

Municipal Services

Coupled with the issue of payments to the city is the question of the form and amount of municipal services received by the ports. All of the ports contacted pay for the public utility costs of water and sewerage, either on a per unit basis or as a flat rate. Some, in addition, pay for legal, accounting, computer, and administrative assistance, while others use only in-house services. Most own one or more fire boats to protect vessels and dockside facilities. In the event of shore emergencies which require conventional fire-fighting equipment, a city fire departments generally provide supplementary service. In no instance was a prearranged formal contract found to cover payment for this service; services were provided without charge. Most ports either employ guards or have their own police force. City police departments supplement port security without charge in some cities, and in others at cost.

Massport's arrangement with the City of Boston for provision of municipal services is similar to that at other ports contacted in the survey. It has a fireboat, which is supplemented by the city's fire department without charge, when necessary. Massport also employs its own guards. When city police are used, Massport pays for them.

Port Development Financing Methods

Ports vary widely in their methods of financing development. Table III-2 displays representative sources of development funds for a sampling of ports. For most ports, bond issues are the major source of development funds. Ports may issue general obligation bonds, revenue bonds, or both. Those ports that can issue both usually issue revenue bonds. When they issue general obligation bonds, it is generally for non-revenue-producing ventures.

The Port of New Orleans utilizes a unique form of development subsidy. The Louisiana Constitution provides that a portion of state gasoline tax revenues be used to finance debt service on port development bonds issued by the State. The port agency no longer has the power to float its own bonds. Within a few years the bonds, issued in the 1920's and '30s, for which the gasoline tax was originally intended to pay will be retired. When this occurs, the tax commitment will be reduced to about $500,000 annually and assigned to more recent bond issues.

When comparing port authorities' financial arrangements and their methods of financing development, it is important to distinguish between those agencies whose jurisdiction is limited to a port and those whose control extends to other operations such as airports, bridges, and tunnels. The latter operations, being more profitable than port operations, contribute to the ability of multi-functional authorities to cover deficits produced by port operations.

Table III-2.

REPRESENTATIVE FINANCING METHODS OF U.S. PUBLIC PORTS
(For Development Expenditures January 1, 1966 - December 31, 1972)

Port	Reinvestment of Port Earnings	General Obligation Bonds	Revenue Bonds	State Subsidy	Federal Subsidy	Other	Total
New London, Connecticut	-	100%	-	-	-	-	100%
Wilmington, Delaware	10%	90%	-	-	-	-	100%
Newport News, Virginia	-	-	33%	67%	-	-	100%
Norfolk, Virginia	-	-	-	100%	-	-	100%
Portsmouth, Virginia	-	-	-	100%	-	-	100%
Charleston, S.C.	30%	70%	-	-	-	-	100%
Jacksonville, Florida	5%	80%	15%	-	-	-	100%
Miami, Florida	-	-	100%	-	-	-	100%
Panama City, Florida	-	-	67%	-	33%	-	100%
New Orleans, Louisiana	24%	49%	-	27%	-	-	100%
Lake Charles, Louisiana	64%	-	-	-	36%	-	100%
Houston, Texas	9%	85%	6%	-	-	-	100%
San Diego, California	-	-	-	-	36%	64%*	100%
Long Beach, California	76%	-	24%	-	-	-	100%
Los Angeles, California	41%	-	59%	-	-	-	100%
San Francisco, California	-	62%	38%	-	-	-	100%
Oakland, California	2%	-	43%	-	24%	31%**	100%
Portland, Oregon	1%	99%	-	-	-	-	100%
Tacoma, Washington	3%	-	97%	-	-	-	100%
Seattle, Washington	79%	-	4%	-	6%	11%***	100%
Selected Port Average	17%	32%	24%	15%	7%	5%	100%

* Government Development Bonds
** Certificate of Indebtedness
***Revenue Warrants

Source: U.S. Department of Commerce
Maritime Administration
Division of Ports

CHAPTER IV

ENVIRONMENTAL ANALYSIS

INTRODUCTION

Prior to 1970, it was possible for most types of development projects, particularly those done by public agencies, to proceed without careful consideration of possible environmental damage. The National Environmental Policy Act of 1969, the Clean Air Act of 1970, and the Federal Water Pollution Control Act of 1972 have radically altered that state of affairs. Consideration of a project's impacts on air and water quality are now a necessary part of the development process.

This chapter discusses the following:

1. The environmental baseline--that is, the present levels of air and water contamination--in the vicinity of Boston Harbor;
2. The likely impacts of further port development on air and water quality, and, given these impacts;
3. The federal and state environmental regulations which will govern certain of the development's aspects.

The first two sections provide a generalized environmental assessment of further port development as well as the information necessary to do a more thorough environmental impact review when a site is chosen and preliminary design specifications prepared. The environmental baseline represents the starting point for an incremental analysis of environmental effects (i.e., the level to which any new development adds), and highlights problem areas and pollutants. The impacts section identifies activities likely to occur given construction and operation of a new terminal, and the effects these activities will have on air and water quality. The legislative and regulatory review identifies federal and state environmental permit/approval procedures which will be required, given certain assumptions about site and facility characteristics. The objective of this last section is to facilitate Massport's compliance with environmental regulations.

BASELINE DESCRIPTION

Introduction

A baseline environmental quality description of Boston Harbor and its environs is necessary to evaluate the incremental environmental effects expected to result from possible Inner Harbor development. Our discussion of baseline environmental quality in the Harbor region provides:

1) descriptors of present water quality (including pH level, turbidity, biochemical oxygen demand (BOD) and coliform bacteria counts) and

2) measures of pollutants affecting air quality, including carbon monoxide (CO), hydrocarbons (HC), total suspended particulates (TSP), sulfur dioxide (SO_2) and nitrogen oxides (NO_x).

The description also includes the State standards for regulation as well as water and air quality conditions presently observed in the region relative to these standards. The objective of this portion of the environmental chapter is to pinpoint trouble spots where standards are in danger of being exceeded by additional development or expanded use of present facilities.

Present Water Quality

Boston Harbor consists of the small Inner Harbor which receives flows from the Charles and Mystic Rivers, and the large Outer Harbor including Dorchester Bay which receives flows from the Neponset River. The most significant waste inputs contributing toward the degradation of water quality in the Harbor are sewage outfalls and urban runoff. Although there is strong tidal interaction between the Harbor and Massachusetts Bay which insures quick transport and mixing of locally generated wastes with the larger water mass of the Bay (Resource Analysis, 1973), water quality, noticeably improved since the sixties, is still very poor and below its standard of classification in many sections.

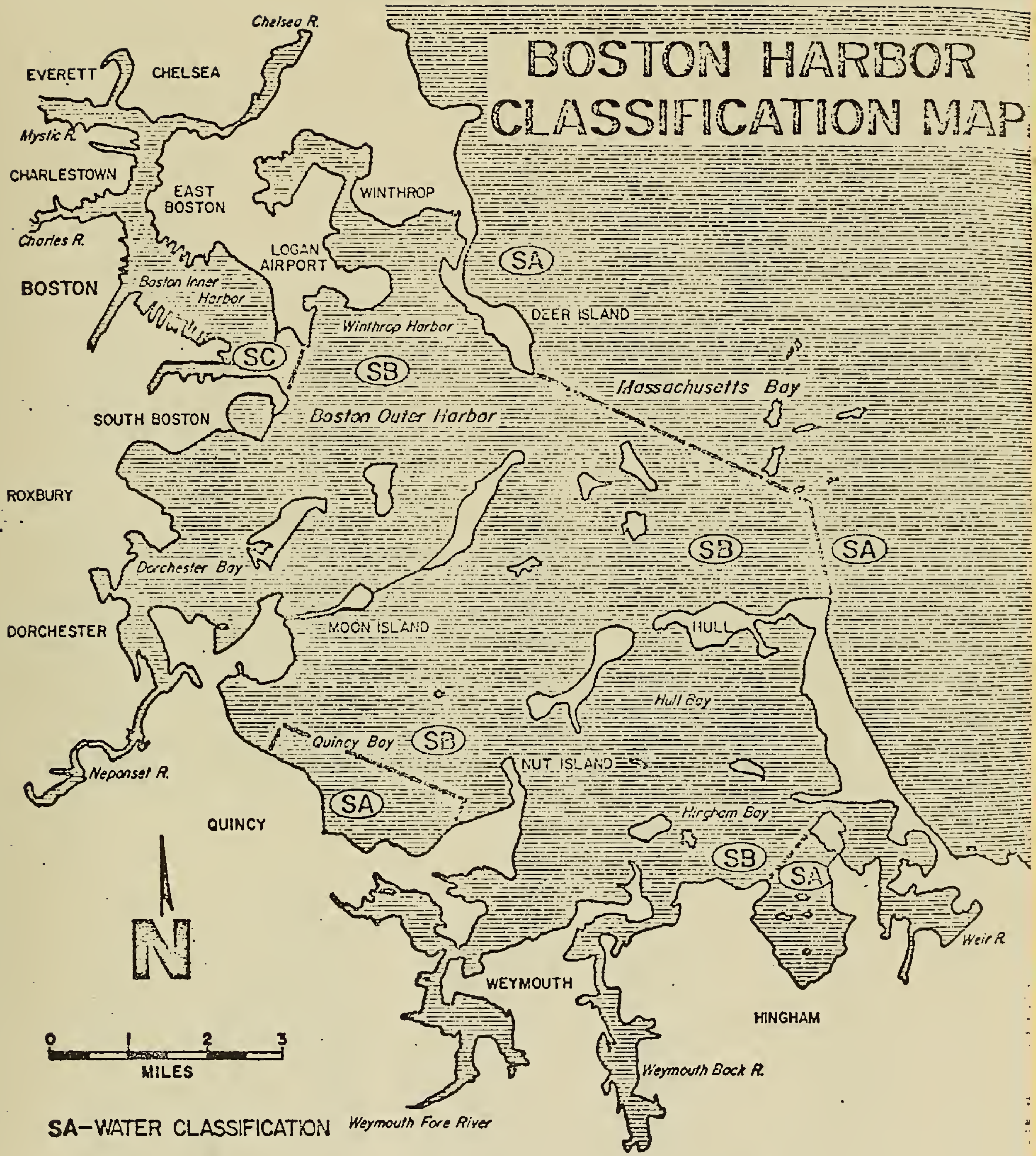
Water Quality Standards and Violations

The water quality standards adopted for the Inner and Outer Harbors are shown in Figure IV-1. The Inner Harbor's Salt Water-C (SC) classification, the lowest possible, represents its deteriorated condition and the difficulty of controlling all of the factors contributing to the degradation of this small body of water. The SC classification denotes waters suitable only for:

1) aesthetic enjoyments,
2) recreational boating,
3) a habitat for wildlife and common food and game fishes indigenous to the region, and
4) for certain industrial uses. (see Division of Water Pollution Control Rules)

Under the strain of intense urbanization, various sections of the Inner and Outer Harbors have overcome even the fortuitous conditions of strong tidal interaction between the Harbor and the Bay and have failed to maintain a condition which meets the standards of their designated classification (see Table IV-1). Neither are these sections expected to correct their sub-standard condition under anticipated future use.

The major water quality problem in the Harbor is bacterial contamination. Coliform bacteria counts are particularly high in the vicinity of combined sewer outfalls, especially along the Dorchester Bay beaches and in the Inner Harbor. Coliform concentrations at the beaches exceed state swimming standards during all wet weather events and usually for several tidal cycles thereafter. High coliform concentrations have closed all areas of the Harbor completely even to commercial shell fishermen who have access to depuration plants. Other water quality problems in the Harbor include moderate dissolved oxygen problems in the Inner Harbor during summer months, suspended metals in some locations and volatile solids, metals and nutrients in high concentrations in all Harbor sediments (Resource Analysis, 1973).



Source: Resource Analysis, Inc.
1976

Figure IV-1

TABLE IV-1

Boston Harbor Environmental Classification

BOUNDARY	PRESENT USE	ANTICIPATED FUTURE USE	PRESENT CONDITION	CLASSIFICATION
Boston Harbor inside a line from the southerly tip of Deer Island to Boston Lighthouse to Point Allerton in Hull except as denoted below	Bathing, recreational boating, fish & wildlife propagation, fishing, restricted shellfishing, assimilation	Same	SB	SB
Boston Inner Harbor westerly inside a line from the southerly tip of Governor's Island to Fort Independence including the Charles, Mystic, and Chelsea (Creek) Rivers and Fort Point Channel	Fish & wildlife propagation, fishing, industrial processing and cooling	Same	SC	SC
Quincy Bay in Quincy from Bromfield Street near the Wollaston Yacht Club northerly to buoy C "1" southeasterly to the "Willows", sometimes known as Lord's Point, on the northerly shore of Houghs Neck, Quincy	Bathing, recreational boating, fish & wildlife propagation, fishing, restricted shellfishing	Same + shellfishing	SB	SA
Hingham Harbor in Hingham inside a line from Crows Point to Worlds End Promontory	Bathing, recreational boating, fish & wildlife propagation, fishing, restricted shellfishing	Same + shellfishing	SB	SA

Source: Resource Analysis, Inc.

TABLE IV-1, cont'd

Boston Harbor Environmental Classification

BOUNDARY	PRESENT USE	ANTICIPATED FUTURE USE	PRESENT CONDITION	CLASSIFICATION
Weymouth Fore River in Quincy and Weymouth	Recreational boating, fish & wildlife propagation, fishing, industrial processing & cooling	Same + restricted shellfishing	SC	SB
Weymouth Back River in Weymouth and Hingham	Recreational boating, fish & wildlife propagation, fishing, industrial processing & cooling	Same + restricted shellfishing	SC	SB
Weir River in Hull and Hingham	Bathing, recreational boating, fish & wildlife propagation, fishing, restricted shellfishing, industrial processing & cooling	Same	SB	SB
Neponset River in Boston, Milton, and Quincy	Recreational boating, fish & wildlife propagation, fishing, industrial cooling & processing	Same + restricted shellfishing	SB	SB
Metropolitan: North Coastal, Spot Pond; Stoneham & Medford, Charles, Norumbega Reservoir; Weston, Charles, Weston Reservoir, Weston	Water supply	Water supply	A	A

TABLE IV-1, cont'd.

Boston Harbor Environmental Classification

BOUNDARY	PRESENT USE	ANTICIPATED FUTURE USE	PRESENT CONDITION	CLASSIFICATION
Cambridge: Stony Brook Reservoir, Waltham, Lexington, Lincoln; Upper Hobbs Brook Reservoir, Lower Hobbs Brook Reservoir	Water supply	Water supply	A	A
Hingham: Accond Pond in Hingham, Rockland, Norwell; Accond Brook source to entrance, Accond Pond, Hingham	Water supply	Water supply	A	A
Fresh water streams flowing into Boston Harbor area unless specifically denoted elsewhere	--	--	--	B

Present Air Quality

Ambient air quality in Boston has been monitored since the mid-sixties. The pollutants of interest in this study, given expected activities arising from development, are carbon monoxide (CO), hydrocarbons (HC), total suspended particulates (TSP), sulfur dioxide (SO_2), and nitrogen oxides (NO_x). Observed ambient air quality levels for each of these pollutants in Boston for the most recently completed observation period are given in Table IV-2.

Air Quality Standards and Violations

In the Boston Air Quality Control Region, federal and state ambient air quality standards (see Table IV-3) are presently exceeded for CO and oxidants. The measurements of ozone levels (ozone being the principal component of oxidant) are made during summer months, the only time when oxidant levels are significantly high. High oxidant levels indicate excess hydrocarbon emissions, HC being a principal oxidant precursor and the focus for oxidant control strategies. Levels of TSP and SO_2 are presently below their stipulated standards. NO_x levels during 1975 remained close to standard levels, with the standards exceeded at only one monitoring site, Kenmore Square.

ENVIRONMENTAL IMPACTS OF PORT DEVELOPMENT

Introduction

Our research and available environmental quality data enable us to review expected water and air quality changes. First, we analyze the effects on water quality of three activities associated with further port development--filling and construction, disposal of ships' spoils, and dredging. We anticipate that dredging will have the most significant water quality impacts and, consequently, we review its effects in most detail. Next, we analyze the air quality impact of several activities occuring with construction and operation of a new port facility--on-land dredge disposal, increased ship traffic, and increased land vehicle traffic. We anticipate that increases in truck traffic, resulting in higher levels

TABLE IV-2

Observed Ambient Air Quality Levels

Massachusetts Executive Office of Environmental Affairs, Division of Air and Hazardous Materials

Air Quality from January 1975 through December 1975

SULFUR DIOXIDE (SO_2) by West-Gaeke Bubbler (ppm)

Location Site	Annual Arithmetic Mean	Maximum 24 Hour	No. Times Mass & Federal 24 Hour Primary Standard Was Exceeded (0.14 ppm)
J.F.K.	.011	.044	0
Kenmore Square	.013	.059	0
South Bay	.007	.034	0

TOTAL SUSPENDED PARTICULATES (TSP) by HIVOL (ugm/M^3)

Location Site	Annual Geometric Mean	Maximum 24 Hour	No. Times Mass & Federal Primary Standard Was Exceeded 260 ugm/M^3	No. Times Mass. & Federal Secondary Standard Was Exceeded 150 ugm/M^3
J.F.K.	61	145	0	0
Kenmore Square	99	206	-	-
South Bay	63	150	0	0

NITROGEN DIOXIDES (ug/M^3)

Location Site	Annual Average	Annual Arithmetic Mean
J.F.K.	66	35
Kenmore Square*	102	53
South Bay	-	28

*Annual primary standard exceeded

CARBON MONOXIDE (mg/M^3)

Location Site	High 1 Hour	High 8 Hour	No. Times Mass & Fed. 8 Hour Avg. Primary Standard Was Exceeded ([illegible])
J.F.K.	-	-	-
Kenmore Square	25.1	16.1	59
Vi[illegible]	25.1	15.8	20

TABLE IV-2

(continued)

OZONE (ug/M^3)

Location Site	High 1 Hour	No. Times Mass & Fed. 1 Hour Avg. Primary Standard Was Exceeded (160 ug/M^3)
J.F.K.	--	--
Kenmore Square	214	8

Source: Surveillance and Analysis Division, EPA Region I, 1975 Annual Report on Air Quality

TABLE IV-3

Massachusetts and Federal Ambient Air Quality Standards

CONTAMINANT	AVERAGING TIME	TYPE OF AVERAGE	PRIMARY STANDARD		SECONDARY STANDARD	
			AVERAGE CONCENTRATION			
			ugm/M^3	ppm	ugm/M^3	ppm
Sulfur Oxides (SO_2)	Year	Arithmetic Mean	80	0.03		
	Day	Maximum a	365	0.14		
	3 Hour	Maximum a	None	None	1,300	0.5
Total Suspended Particulates (TSP)	Year	Geometric Mean	75	--	60b	--
	Day	Maximum a	260	--	150	--
Carbon Monoxide (CO)	8 Hours	Maximum a	10 (Milli-grams)	9	Same	Same
	1 Hour	Maximum a	40 (Milli-grams)	35	Same	Same
Photochemical Oxidants (O_3)	1 Hour	Maximum a	160	0.08	Same	Same
Hydrocarbons (Non-Methane)	3 Hours	Maximum a,b Between 6 & 9 A.M.	160	0.24	Same	Same
Nitrogen Dioxide (NO_2)	Year	Arithmetic Mean	100	0.05	Same	Same

a) Federal standards other than annual average may be exceeded once per year.

b) A guide to be used in assessing implementation plans to achieve the 24-hour standard of hydrocarbon and carbon monoxide emissions, constitute the most important air quality impact.

Water Quality Impacts

The adverse effects on present water quality expected to result from possible harbor development will result from construction and maintenance activities associated with new facilities. Long-term effects of maintenance activities are likely to be the most significant impacts. These activities include:

1) physical alteration of the shoreline due to filling and pier and bulkhead construction,
2) disposal of ships' spoils,
3) harbor dredging and dredge disposal required by new construction and channel maintenance.

These activities are all currently undertaken in the harbor to a certain degree. Dredging in particular is regularly performed as a channel maintenance activity. It is needed to clear channels of natural sedimentation in harbors and bays and to enlarge harbor channels for vessels of deeper drafts.

Physical Alteration of the Shoreline

Shoreline intertidal and adjacent subtidal areas are usually areas of high-standing crops of organisms which provide the initial habitat for most post-larval and juvenile fish and crustaceans. These shallow intertidal and subtidal fringe areas can be completely destroyed by bulkhead construction since the purpose of such construction is generally to provide deep water for boat access. Eliminating shallow water areas reduces the production of plankton, and since sunlight is no longer able to reach the Harbor bottom, the number of benthic (bottom-dwelling) organisms inhabiting the area decreases. Construction of bulkheads may also adversely alter natural circulation and create stagnant areas which can develop into sinks for pollutants. Over time, adjacent productive areas could be seriously affected. In addition, any type of marine construction which may restrict or prohibit the tidal flushing of a salt marsh will cause slow death to the marsh and a drastic reduction in species diversity and communities in surrounding waters.

Ships' Spoils Disposal

The Maritime Administration of the Department of Commerce is currently undertaking a pollution abatement program whose goal is to assist in the development of a pollution-free shipping industry. A significant proportion of the program's resources has been devoted to investigating the pollution effects of ship sewage wastes discharged and to evaluate alternative technologies available for handling the waste.[1] Program results have thus far indicated the harmful effects of ship sewage discharge to be:

1) bacterial pollution that can infect humans with typhoid, dysentery, cholera and other waterborne diseases.
2) excessive oxygen demands which deplete the quantity of free oxygen in water.
3) blockage of sunlight which upsets aquatic environments.
4) floating sewage which causes scum and foam to develop on the water's surface. (Chance, 1974)

The severity of these effects depends in part upon the rate at which sewage discharged from ships in the harbor is dispersed. Although little is known about dispersion effects of sewage in small bodies of water, one study recently completed by the Naval Undersea Center in San Diego concluded that ships can stay in a small harbor longer than originally anticipated without danger of sewage contamination of the shoreline. A number of releases of dyed sewage were made at several different discharge rates. Movement of the sewage was traced by photography, bacterial counts, dye and BOD measurements in surrounding water and on the shoreline. Results show the diffusion of sewage towards shoreline much lower than predicted from open-ocean data. (Donahue, 1973)

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[1] Among the available practicable means of shipboard sewage treatment are: holding tank, recirculating system, vacuum flush system, physical chemical systems, electro-chemical systems, wet air oxidation systems and evaporator/sludge incineration. (For more detailed information see Donahue, 1973)

Dredging and Dredge Disposal

Most of the dredging activity in Massachusetts is undertaken to retain the width and/or depth of existing navigation and shipping channels. (CZM Dredge Practices, 1974). There are two types of dredging methods used, hydraulic and mechanical. Mechanical dredging involves open sea disposal. It is the most prevalent dredge method in Massachusetts because typical dredging projects in the harbor region involve removal of bottom material too unstable or toxic for beach nourishment and/or dune creation. It has been difficult to establish an accurate estimate of the amount of materials dredged and dumped annually in and around the harbor because, although the U. S. Army Corps of Engineers retains responsibility for maintenance dredging of existing bays and channels, most of the dredging is performed by site owners or private contractors and is done, at best, sporadically. Yet most dredge material removed from the harbor is known to be "polluted spoils" containing high concentrations of heavy metals, pesticides, and organic and petroleum wastes (CZM, 1974). This material must therefore be disposed of in designated "polluted spoils" disposal areas. Along the Massachusetts coast, only one of the seven open water disposal sites is approved for polluted spoils. A second polluted spoils disposal site in Rhode Island Sound is presently under study by the U. S. Army Corps of Engineers.

-Dredging-

Dredging removes organisms that live both on and within the bottom sediments. This reduction in the number of organisms in the dredge area may lead to a decrease in the diversity of species with subsequent impact on dependent marine resources. Dredging also removes benthic vegetation such as eelgrass which is used by the bay scallop for attachment and growth, by young eels and sculpin for protection from predators and by brant (small geese that migrate chiefly along the Atlantic coast) as a major food source. Benthic vegetation is also important because it is a part of the cycle of nutrients through marine ecosystems and because it is a major source of detritus for deposit feeders (CZM, 1976). In intertidal areas it may take at least eight years after dredging operations for the reestablishment of the original fauna. This reduction in an area's potential as a feeding and fishing source has serious effects upon the productivity of the whole water body, since many organisms depend upon the nutrient production and export of the salt marshes and the richness and diversity of tidal flat populations for feeding, spawning, and nursery activities (CZM, 1976). Adverse effects of dredging activity are more severe in areas where:

1) water circulation is limited;
2) the bottom is rich in organic matter;
3) the sediments are polluted with heavy metals; or
4) salt marshes are nearby.

Mechanical dredging, as practiced in Boston Harbor, generates more suspended material at the dredge site than does standard hydraulic dredging and affects an area larger than the immediate site. The suspended sediment dislodged by mechanical dredging makes the water turbid and can cause the death of organisms by blocking the light necessary for photosynthesis and by clogging the gills and siphons of fish, molluscs, and other marine fauna (CZM, 1976).

-Dredge Disposal-

Since filling coastal wetlands with dredge disposal has been virtually eliminated, the material is usually disposed of at sea. The movement of pollutants once dumped at ocean disposal sites depends upon:

1) the nature and consistency of the dumped material;
2) the method of disposal; and
3) the transport processes (wave and current erosion) affecting the dump site.

Most contaminated dredge spoils are primarily fine-grained silt and clay. When dumped from a scow, some of the material falls directly to the bottom, some is carried laterally by currents, and a portion is dispersed near the surface, resulting in substantial mixing of dredged material with the water (CZM, 1976).

The spoils disposal has both acute and chronic biological effects. Many benthic and free-swimming organizms are buried and suffocated by the dumped material. Moreover, dredge disposal causes significant disruption of bottom habitats. Although recolonization of the dump sites occurs to some extent, the biological balance of the community is permanently altered. Dredge material from the Inner Harbor is likely to contain concentrations of heavy metals, pesticides, and organic and petroleum wastes. A potentially greater problem than burial and habitat destruction is the absorbtion, accumulation and recycling of these heavy metals, pesticides, toxic hydrocarbons, free sulfides and other contaminants by the marine organisms. Some of these substances are carcinogenic and/or mutagenic if consumed by man. The cycling of these contaminants through the food chain depends on such factors as the clay, organic and bacterial content of the spoils, pH and local currents. Other acute impacts of dredge disposal are increased nutrient release and increased oxygen demand.

Chronic impacts result from the physical alteration of dredging and spoil disposal and the subsequent hydrologic and ecologic change to the envrionment. Among these chronic effects are:

1) altered circulation causing salinity and temperature changes;
2) changes in sediment turnover;
3) substratum change of particle size distribution in bottom sediment;
4) evolution of resistant biological communities implicating permanent ecologic change (CZM, 1974).

Research into the many unanswered questions about the effects of dredging and spoil disposal is continuing. A five-year, $30 million Dredged Material Research Program sponsored by the U.S. Army Corps of Engineers began in 1973 (CZM, 1974). For the interim, dredged spoil criteria have been established by EPA to insure judicious planning of spoil disposal (see Table IV-4).

Air Quality Impacts

Adverse impacts on present ambient air quality in the Boston metropolitan region expected to result from the proposed harbor development will result primarily from several different activities, all associated not with construction, but rather with the operation of a new facility. These activities include:

1) on-land dredge disposal;
2) increased vessel traffic; and
3) increased truck traffic.

Of greatest consequence to future ambient air quality will be increases in land vehicle, principally truck, traffic.

TABLE IV-4

Dredged Spoil Criteria Based on Bulk Analysis[1]

"Highly polluted" dredgings are those that exceed the following EPA criteria:

Sediments in Marine Waters	Concentration % (dry weight base)
Volatile Solids	6.0
Chemical Oxygen Demand (COD)	5.0
Total Kjedahl Nitrogen	0.10
Oil Grease	0.15
Mercury	0.0001
Lead	0.005
Zinc	0.005

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[1] Bulk analysis measures the percent of the total dry weight of the various constituents.

Source: Massachusetts Coastal Zone Management Coastal Review Center, Review of Dredge and Spoil Disposal Practices in Massachusetts 1974.

On-Land Dredge Disposal

One of the most common land disposal methods used is retention of spoils in a diked confinement area. If the spoil is compacted by mechanical dewatering and covered with humus, it can be used as landfill. Shortage of land close to dredging operations threatens to limit further dike construction, however. The air quality problems arising from confinement areas include odor, misquitoes, noise during disposal activities, and build-up and emission of hydrogen sulfide, not to mention emmisions of and odors from neutralizing and stabilizing chemicals used to pretreat the dredged material. Aside from being a serious physical problem with little available information for control, the issue also generates significant local opposition (CZM, 1974).

Increased Vessel Traffic

Another source of increased emmisions to the air will be from the operation of vessel proplusion systems accompanying increased vessel movements in the harbor. The pollutants emmited are primarily TSP, NO_X and sulfur oxides, primarily SO_2, with some CO and HC emissions if good combustion is not maintained in the boiler (Linnstaeder, 1974). While important to consider in a complete environmental analysis, these emissions seem insignificant relative to both total nationwide and local emissions inventories. Nationwide, ship stack gas emissions represent less than 1% of total TSP, SO_X and NO_X emissions.[2] Within seven metropolitan areas surveyed in 1974, stack gas emissions contributed an average of 3.7% of total SO_2 emissions, 1.94% of total TSP emissions and 3.37% of total NO_X emissions (see Table IV-5).[3]

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[2] .35% of total TSP emissions, 19% of total SO_X emissions, and 97% of total NO_X emmisions.

[3] Ship stack gas emissions also can be argued to be insignificant relative to federal standards for similar, although stationary, technology. EPA's New Source Performance Standards (NSPS) for steam generator driven power plants apply only to plants with heat inputs greater than 250 BTU's per hour, the equivalent of a 24,000 shaft-horsepower ship engine. In 1970, the average horsepower of the U.S. merchant marine was 10,000 hp. Although trends toward even larger tankers are sure to have raised this average, even the largest tankers operate at only 10% of full power while in port (Linnstaeder, 1974).

TABLE IV-5

Vessel Emissions' Contribution to Total Emissions Inventories of Seven U.S. Ports

Port	1971 Annual Tons of Cargo (000,000)	SO_2		TSP		NO_x	
		Tons/yr	% total	Tons/yr	% total	Tons/yr	% total
San Francisco	2.1	4,300	5.6	511	.9	2,040	.8
Buffalo	11.1	1,500	.36	820	.58	460	.3
Houston-Galveston	68.4	5,050	3.5	380	.25	1,180	.5
Miami	2.6	3,370	2.25	1,250	1.85	2,760	2.4
Portland	15.5	220	.7	20	.18	70	.2
New Orleans	120.1	8,700	12.8	6,300	9.4	13,200	18.4
Seattle-Tacoma	14.6	2,000	.7	140	.4	450	
Total			25.91		13.56		23.5
Average			3.70		1.94		3.3

Annual tons of cargo through Boston in 1971 = 26,200,000

Source: Linnstaeder, 1974

There are two approaches to calculating estimates of increases in stack gas emissions due to increased vessel traffic:

1) a rough estimate can be calculated by looking at stack gas contributions to emissions inventories in ports with similar throughputs (see Table IV-5; note: this approach makes two considerable assumptions, that the composition of the vessel fleets of the other ports and Boston are similar and that the climatic conditions are similar).

2) a more precise estimate can be generated using emission factors developed for similar power technologies which utilize the same type of fuel -- this second method involves using emission factors developed by EPA for steam-generated power plants fueled by No. 6 oil[4] and multiplying this by the average rate of vessel fuel consumption.[5]

Land Vehicle Traffic

The major air pollution problem exacerbated by port development stems from the truck traffic generated by cargo-handling terminals, assuming that the bulk of commodities passing through the port are transported on land by truck, rather than rail. It has been estimated, for example, that container port operations at the Port of Boston might generate on average, 300-400 two-way truck movements per working day by 1990 (CZM, 1976).

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[4] For every ton of No. 6 oil burned there are two pounds of TSP emissions, 39.2 pounds of SO_2 emissions and 26.2 pounds of NO_x emissions; the average rate of vessel fuel consumption is .57 pounds/ship hour. (Linnstaedter, 1974)

[5] Even this more precise estimate is somewhat inaccurate due to several factors. EPA's sulfur emissions figure assumes a No. 6 oil with a 1% sulfer content, when in fact, the average sulfur content of the No. 6 produced in the U.S. may be half a percentage higher (Linnstaedter, 1974). Although a small percentage, this amount increases emissions by a factor of two since every pound of sulfer in fuel results in two pounds of sulfer oxide emissions (Linnstaedter, 1974). Secondly, the propulsion technologies of the vessels using the terminal are not likely to be 100% steam generator technologies since, although steam is the dominant technology of the U.S. fleet (84.3%) diesel engines are the dominant technology in foreign fleets (Linnstaedter, 1974). We are unaware of emission factors developed for deisel powered vessels, although these emissions may be comparable to emissions from diesel powered equipment or heavy duty vehicles.

Increases in HC and CO emissions are the principal air quality impacts stemming from such increases in truck traffic, and they would be particularly severe along access routes to major terminals and highways.

Precise estimates of truck traffic's contribution to air quality degradation can be derived from estimates of tonnage flows through the new facility, which in turn must be translated to truck movements. Given the number of truck movements, assumptions must then be made about the following parameters:

1) the percentage of total truck movements occuring in an idle mode, low speed and high speed modes;
2) the composition of the terminal-using truck fleet with respect to model year (i.e. assume identical to nationwide);
3) the composition of the truck fleet with respect to engine technology (gasoline or diesel).

Making these assumptions permits the use of EPA's Emission Factors for heavy duty gasoline-powered and diesel-powered vehicles, found in Supplement No. 5 for Compilation of Air Pollutant Emission Factors.

Increased truck traffic is also expected to create congestion problems along entrances, exits and major access routes to the facility and nearby highways. These effects may also be estimated by the number of two-way truck movements expected to serve the facility by 1990. Congestion will further increase the amount of HC and CO emissions delivered within the metropolitan area. Trucks will remain within the city for longer periods of time and, going at slower speeds, will emit more pollutants per mile.

ENVIRONMENTAL REGULATION OF PORT DEVELOPMENT

Introduction

This section reviews federal and state regulation of the activities and impacts discussed in the previous section. Our discussion covers only strictly environmental regulation, that is, rules governing activities which affect air and water quality. Other aspects of the proposed development, such as impacts on historical or recreational areas which may also require permits or approvals from federal and state agencies, are not considered.

The section begins with an explanation of the assumptions about the site and facility that are necessary to proceed with our environmental legislative analysis. We then present the federal and joint federal-state regulatory mechanisms which apply to port development. Finally, state permitting procedures are discussed. These procedures are summarized in a "Development Permit Pathway" (see Table IV-6). Each section includes information on the permit granting agencies, the circumstances in which the permits apply, general criteria for granting the permits and descriptions of the procedural steps required to secure the permits. In addition, the state regulation review includes a discussion of the relation between the regulatory exemption granted Massport by its enabling legislation and the authority of present state environmental controls.

Assumptions

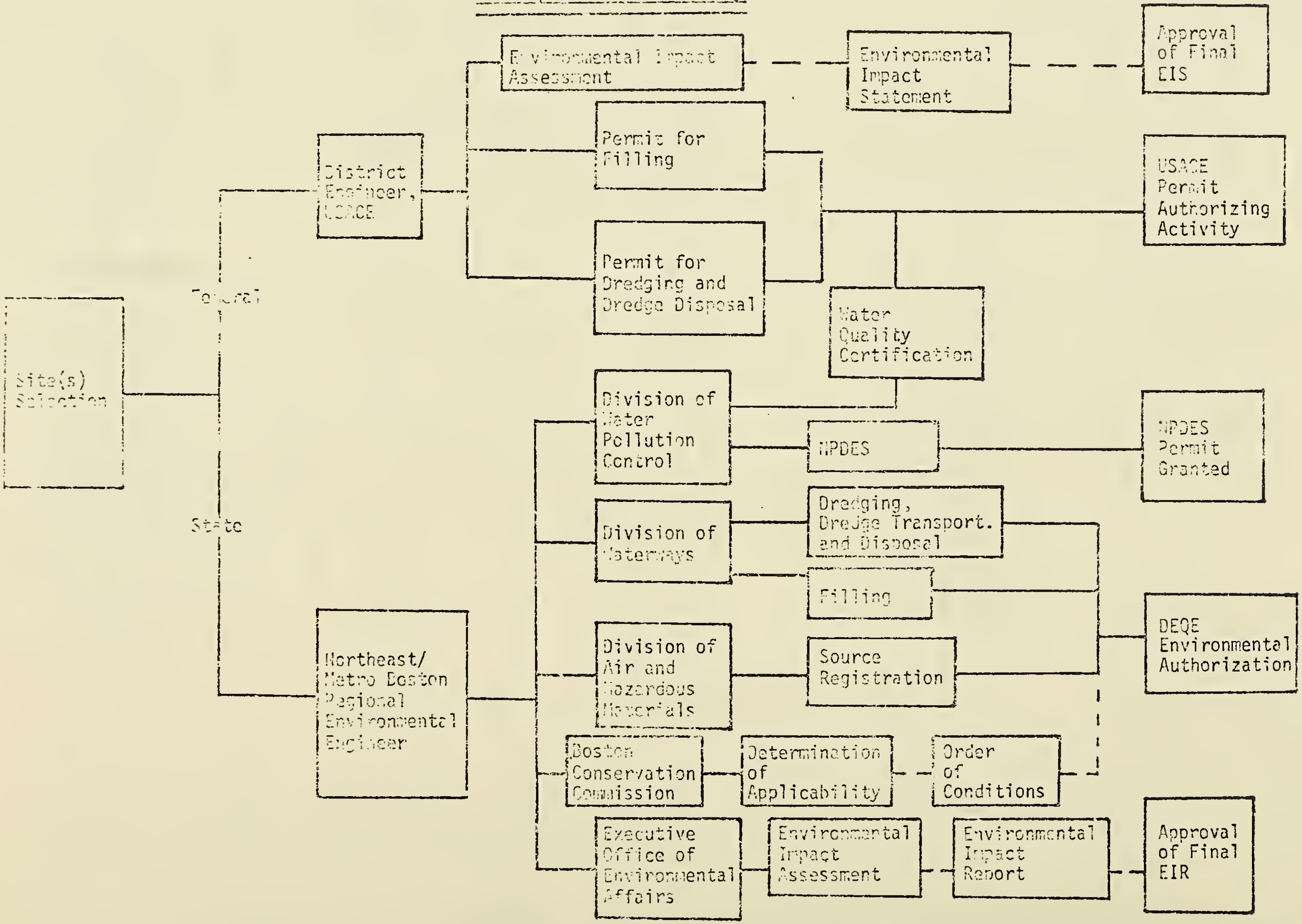
The scope of environmental regulation at state and federal levels is broad, covering many contingencies. Determining whether or not a particular regulation permit would apply to the development recommended earlier in this report depends on specific site and facility characteristics which will not become clear until a site is chosen and preliminary design specifications drawn up. Consequently, for purposes of this part of our environmental analysis, it was necessary to make certain assumptions to restrict the scope of our study. Criteria for selecting our assumptions were that they represent a reasonable outcome, given our knowledge about sites presently available in the Inner Harbor; and that, where several different assumptions are reasonable, the assumption chosen involves more rather than less regulation.

The circumstances that were assumed to be true of any new port development are the following:

1) The terminal will either purchase its electrical power directly from a public utility or use an already existing power plant located on the site. Massport will not construct a new generating facility.

TABLE IV-6

Development Permit Pathway


Site(s) Selection
Federal
State
District Engineer, USACE
Environmental Impact Assessment
Permit for Filling
Permit for Dredging and Dredge Disposal
Environmental Impact Statement
Approval of Final EIS
USACE Permit Authorizing Activity
Water Quality Certification
Northeast/ Metro Boston Regional Environmental Engineer
Division of Water Pollution Control
NPDES
NPDES Permit Granted
Division of Waterways
Dredging, Dredge Transport. and Disposal
Filling
Division of Air and Hazardous Materials
Source Registration
DEQE Environmental Authorization
Boston Conservation Commission
Determination of Applicability
Order of Conditions
Executive Office of Environmental Affairs
Environmental Impact Assessment
Environmental Impact Report
Approval of Final EIR

2) The sanitary sewage generated by the facility will be disposed of by connecting to a municipal sewage line or using an already existing treatment works located on the site. Massport will not construct a new treatment works.

3) Sewage from ships using the terminal will be disposed of through handling facilities at the terminal or out at sea.

4) Construction will involve dredging and filling activities.

5) Operation of the terminal will involve more maintenance dredging than is presently being carried on in the Harbor, and greater volumes of ship and truck traffic than presently occur at Moran.

The object of excluding only the most unlikely possibilities affecting air and water quality, such as construction of an on-site power plant and treatment works, is to ensure that the scope of our regulatory review will err on the side of being too broad rather than too narrow.

Federal Regulatory Programs

The U.S. Army Corps of Engineers (USACE) is the co-ordinating agency at the federal level for all permits relating to construction and operation of facilities affecting coastal waters. The following summary describes the activities for which a permit is required, the criteria for granting a permit, and permit granting procedures and time limits. A more detailed description of notice and review procedures is found in Appendix D. Certificates required from the State Coastal Zone Management agency and Division of Water Pollution Control prior to obtaining a federal permit are described in the next section of this report. Regulatory procedures governing air quality impacts are also described in the following section and in the review of state programs since air quality management, although mandated by federal legislation, is implemented by the states. As the lead federal agency in permit procedures affecting navigable waters, the USACE is responsible for advising applicants of any additional certificates needed.

Regulated Activities

Under the Rivers and Harbors Act of 1899, an Army Corps permit is required to build any structure in any port channelward of the mean high water mark or to alter the course, location, condition or capacity of any navigable water. Section 103 of the Marine Protection Research and Sanctuaries Act authorizes the USACE to issue permits for the transportation of dredged material for the purpose of dumping it in ocean waters and to specify the dumping sites. Section 404 of the Federal Water Pollution Control Act authorizes the Corps to issue permits for the discharge of dredged or fill material into navigable waters at specified disposal sites.[6] Permits for all of the above activites are obtained by submitting one application to the Division Enginer at the USACE Region Office in Waltham. A single permit is granted once all conditions have been met.

Criteria for Granting Permits

The decision whether to issue a permit is based on an evaluation of the probable impact of the proposed structure and its operation on the public interest. Evaluation of this impact requires a careful weighing by the Corps of the benefits of the project and its likely adverse impacts. Authorization of a proposal reflects concern for both protection and utilization of important resources. A broad range of factors relevant to the proposal are considered, i.e. conservation and environmental concerns, flood damage prevention, navigational and economic concerns, etc.

The following general criteria are considered in the evaluation of every application:

1) the relative extent of the public and private need for the proposed structure;

2) the desirability of using alternative locations and methods to accomplish the objective of the proposed work;

3) the extent and permanence of the beneficial and/or detrimental effects which the proposed structure may have on the public and private uses to which the area is suited; and

4) the probable impact of each proposal in relation to the cumulative effect created by other existing and anticipated structures or work in the general area.

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[6] There is an established ocean dumping site 9 miles N.E. of the Boston lightship.

Permit Procedures and Time Limits

The District Engineer is guided by the following time limits in processing permit applications:

1) Public notice should be issued within 15 days of receipt of all required information from the applicant, unless joint notice with state agencies is used.

2) The receipt of comments as a result of the public notice should not extend beyone 75 days from the date of the notice.

3) The record of a public meeting should be closed not later than 15 days after the meeting.

4) The District Engineer should either send notice of denial or issue the draft permit to the applicant for acceptance and signature or forward the application to higher headquarters within 30 days of one of the following whichever is latest: receipt of notice of withdrawal of objections; completion of coordination following receipt of applicant's rebuttal or objections; receipt of the record of a public hearing; closing of the record of a public meeting; or expiration of the waiting period following the filing of the final environmental impact statement (EIS) with the Council on Environmental Quality.

The granting of a USACE permit is considered "significant federal action". Thus, an Environmental Impact Statement (EIS) may be required depending on the magnitude of the proposed project and the nature of the area involved. A determination of the need for an EIS may occur early in the project's development or later on, as additional information is developed. The scope of the EIS depends on the nature of the activity for which the authorization is requested. The applicant will most likely be responsible for any substantial expense incurred in gathering information for an EIS.

As a matter of policy, permits are not issued where authorization of the proposed work is required by state and/or local law and that authorization has been denied.[7] However, initial processing of an application for a Department of the Army permit proceeds until definitive action has been taken by the responsible state or local body to grant or deny authorization.

Joint Federal-State Programs

There are five programs that are authorized by federal and/or federal and state legislation and implemented by the state:

1) The National Pollutant Discharge Elimination System (NPDES)
2) Water Quality Certification
3) Coastal zone management consistency determinations
4) 208 water quality planning
5) State air quality implementation plans, particularly their transportation control plan portion.

The NPDES permit is required for any point source discharge into U.S. Waterways and is jointly administreed by the State Division of Water Pollution Control and the Environmental Protection Agency. This permit would be required if Massport took over an existing treatment works.

Water Quality Certification is administered by the State Division of Water Pollution Control and is required of any applicant for a federal permit involving waterways. The certification is required to assure that any federally permitted discharges comply with state effluent limitations and water quality standards. No federal water permit is granted until this certificate has been obtained. This certification will clearly be required of any port development Massport undertakes since development along navigable waterways requires permits from the U.S. Army Corps of Engineers.

The Coastal Zone Management Act of 1972 requires any applicant for a federal license or permit to conduct an activity affecting land or water uses in the state's coastal zone to furnish a certificate from the state Coastal Zone Management (CZM) agency which indicates that the proposed activity complies with the state's CZM Program. No federal permit is issued until the applicant has received this "consistency determination". It is anticipated that this review procedure will become effective in Massachusetts by September, 1977. However, since CZM's plan supports continued development in already developed areas and water-related activities, i.e. maritime shipping, as the first priority use for coastal lands, this certificate should be more of a help than a hindrance.

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[7] Where the required state and/or local authorization has been denied and procedures for reconsideration exist, a reasonable time (not to exceed 90 days) is allowed for the applicant to attempt to resolve the problem and/or obtain reconsideration of the denial. If the state or local denial or authorization is not resolved, the application for the USACE permit is denied. The District Engineer issues a permit when state determination has been faborable, unless there are overriding factors of national public interest.

The statutory deadline for completion of the 208 plan is November, 1977. When the plan is completed and approved it becomes binding in the sense that all new development must conform to criteria specified in the plan. However, the primary focus of the 208 program is to develop plans for areawide wastewater management, rather than land uses along waterways. Thus, the Boston 208 plan would affect port development only if the development site involved an already existing treatment works.

The provisions of the State Implementation Plan (SIP) for the Boston Intrastate Air Quality Control Region require registration of stationary sources, which would apply should Massport take over a facility with an existing power plant. The transportation control portion of the Plan would regulate Massport's port development activities only if the new facility employs more than 50 workers. If the terminal involves more than 50 employees then Massport must adopt measures that will promote transit use and ride-sharing. There are no provisions in the SIP which directly regulate heavy duty vehicle (truck) traffic or the construction of facilities which generate such traffic.[8] The State Implementation Plan is administered by the Department of Air and Hazardous Materials.

State Programs - Massport's Exemption

While programs mandated by federal environmental legislation clearly provide authority to regulate Massport's activities, the authority provided solely by state environmental legislation is less clear. Massport's enabling legislation explicitly exempts it from "the supervision or regulation...of any department, commission, board, bureau or agency of the Commonwealth" except as provided in the other sections of its enabling act (Chapter 91, Appendix 1-2). This exemption has been recently interpreted to be less absolute than it appears. The Massachusetts Supreme Jucicial Court has ruled that "the absolute language of the enabling act must yield to the absolute language of Section 142E" which authorizes regulation of "all...authorities" by the State Division of Air and Hazardous Materials. (City of Boston v. Massachusetts Port Authority, Et. Al., Mass 308 N.E. 2nd 488). Two criteria for determining whether or not the exemption clause could be overruled can be inferred from this decision:

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[8] Regulation of traffic generating facilities ("indirect sources"), although authorized by the 1970 Clean Air Act, has proven troublesome. EPA has issued interim indirect source regulations, but, under extreme political pressure has been forced to withdraw them.

1) That the regulation must have a public health objective;
2) That the agencies/organizations regulated by the legislation specifically include "all authorities".

Applicable State Programs

All the state regulatory processes that would be applicable to the construction and operation of a terminal facility in the Inner Harbor, given the above facility and site assumptions, are listed in Table IV-7.[9] The table includes citations for the authorizing legislation, the name of the administering agency and division and a brief description of the type of regulatory activity, i.e. licenses, permits, etc. The state environmental legislation

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[9] For Massport's information, we would like to make note here of programs that apply generally to coastal waters and the lands bordering them but not to the Inner Harbor. These programs are the Wetlands Program (Chapter 131, s. 105), the Ocean Sanctuaties Program (Chapter 132, s. 13-17) and the regulation of land acquisition and construction in the Outer Harbor (1970, St. 742, s. 8). All three regulatory processes are administered by the Department of Environmental Management (DEM). The Wetlands Program involves strict regulation of all development in Coastal Wetlands designated for such protection by the Commissioner of DEM. There are no such designations in the Inner Harbor presently nor any anticipated in the next five to ten years. The Ocean Sanctuaries Program involves a similar designation-regulation process. Presently no sanctuaries are designated in the waters south of Lynn and north of Marshfield. Regulation of land acquisition and construction applies to the Outer Harbor only.

TABLE IV-7

Existing Environmental Regulatory Processes in Massachusetts

Law	Agency	Division	Type of Regulation
Water			
Chap.21 s.43	Department of Environmental Quality Engineering (DEQE)	Division of Water Pollution Control	1. Water Quality Discharge Permit 2. Interceptor Connector Permit
Chap.91 s.14	DEQE	Division of Waterways	1. License for Filling and Construction in Tidewaters.
s.52-4			2. License for Dredging ,Transportation and Dumping in Tidewaters
Chap.131s.40-2	DEQE	Boston Conservation Commission	1. Notification Process if Altering "Coastal Wetlands"
Air			
Chap.111s.142A-E	DEQE	Division of Air and Hazardous Materials	1. Registration of Stationary Sources
General			
Chap.30s.61,62	Executive Office of Environmental Affairs		Environmental Assessment and Possibly an Environmental Impact Report

that pertains to Inner Harbor port development is contained in five different chapters of the Massachusetts General Code -- Chapters 21, 30, 91, 111 and 130. In four chapters, the sections authorizing environmental regulation meet the Supreme Judicial Court's criteria for overriding Massport's exemption.[10] However, in Chapter 91, which authorizes the Division of Waterways to regulate construction and dredging in the Commonwealth's tidewaters, the scope and objectives of the regulatory sections may allow Massport's exemption provision to prevail.

Although the language of Chapter 91 seems broad, giving the division authority to license the transportation and dumping of all materials in tidewaters, it is less all-encompassing with respect to construction activities[11] and does not specifically mention the types of organizations and government agencies that are subject to regulation. In fact, Massport's enabling legislation specifically exempts it from the Division's licenses and permits for filling, dredging, building of structures or excavating within the Port of Boston (Chapter 91 Appendix s. 1-6).[12] The objectives of the Division of Waterways -- "to prevent...causes of every kind which...interfere with the navigation of such harbors, injure their channels or cause a reduction of their tidewaters" (Chapter 91 s. 10)-- while clearly important to public safety, is less related to "alleviating a pervasive health problem." (Boston v. Massport, 308 N.E. 2nd 488). It seems that the Legislature intended to keep Massport free of regulation in its own territory, Boston Harbor. Given the ambiguity of the legislation, we would recommend requesting an opinion from the State Attorney General on the applicability of regulations authorized under Chap. 91, s. 14 and 52-54 to port development activities conducted by Massport.

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[10] Chapter 21 s. 43 authorizes regulation of "persons whose activities result in point source discharges to the Commonwealth's waterways or require connections to existing sewer lines". Chapter 21 s. 26A defines "person" as "any agency or political sub-division of the Commonwealth, public or private corporation or authority..." The objective of the Division of Water Pollution Control's regulations is "to enhance the quality and value of water resources and to establish a program for the prevention, control and abatement of water pollution".

Chapter 30 s. 61, 62, which requires an Environmental Assessment, and if so determined by the Secretary of the Office of Environmental Affairs, the more detailed, in-depth Environmental Impact Report, oblige "all... authorities of the Commonwealth" to comply. The objective is to minimize environmental damage.

Chapter 111 s. 142 A-E, which requires registration of all air polluting point sources is the legislation on which the Supreme Judicial Court ruled to override Massport's exemption clause.

Chapter 131 s. 40 prohibits any "person" from removing, filling, dredging or altering any coastal wetland without the approval of the local Conservation Commission. "Person" includes "any corporation, company, business organization, the Commonwealth, political sub-divisions thereof, administrative agency, public or quasi public corporation or body". Conservation Commission approvals or Orders of Conditions are issued based on many criteria, among them whether or not the area is significant to the prevention of pollution.

[11] The department (DEQE) may license and prescribe the terms for "the construction...of a wharf, pier...or other structure, or for the filling of land or flats or the driving of piles in or over tidewater below high water mark."(Chapter 91 s. 14)

Uniform Permitting Procedure

As of October, 1976, the State adopted a new permitting procedure. In the past, permit applicants were required to submit applications for permits to each of the different departments and divisions separately. Each application was reviewed independently of any others and permits were issued or denied independently of each other. While this was not particularly burdensome for those seeking a single permit, applicants requiring many permits were faced with a regulatory maze that was likely to introduce sizable delays into large development projects.

The new procedure represents a simplification and consolidation of this process. From the applicant's point of view there are three basic steps:

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[12] "Upon transfer of the port properties, all the rights, powers and duties pertaining to the Port of Boston Commission...shall be vested in and exercised by the Authority; provided however, the department of public works, acting through the division of waterways, may...issue licenses and permits for filling, dredging, building of structures or excavating within the Port of Boston...PROVIDED NO SUCH LICENSE OR PERMIT SHALL BE REQUIRED TO BE OBTAINED BY THE AUTHORITY."(Chapter 91, Appendix s. 1-6)

1) The filing of an "Authorization for Environmental Assessment", a preliminary form which allows the Regional Environmental Engineer[13] to determine which permits/reviews apply;

2) The submittal of more detailed information at the request of and specified by the Regional Environmental Engineer (REE), who then, with the aid of a computer tracking system,shepherds this information through the various regulatory processes that apply; this culminates in the applicant's

3) Receipt of an "Environmental Authorization" which is the approval for all DEQE statutory reviews.

All permits applicable to Massport, listed in Table IV-7,are included in this review. However, although the REE is responsible for submitting the appropriate information to the Division of Water Pollution Control once (s)he receives it from the applicant, and for coordinating these permits with all others, the Division will continue to issue its own permits. Similarly, the state Environmental Impact Assessment and Impact report occur simultaneously with the DEQE reviews, but separately.[14]

The permits required for Massport and many others are described in considerable detail in the Environmental Engineering Directory, which is an inventory of all DEQE regulatory mechanisms. In an effort not to duplicate the Directory, we have included only brief descriptions of each regulatory procedure in Appendix E. These descriptions include the circumstances under which the procedure applies, criteria for granting the permit/approval and, where available, the time required to secure the permit.

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[13] There are four DEQE regional offices, each headed by a Regional Environmental Engineer. The area office for Boston is the Northeast/metro Boston office.

[14] All agencies of the Commonwealth are required by Chapter 30 s. 61 to "review, evaluate and determine" the environmental impact of all their activities and projects. The Secretary of the Executive Office of Environmental Affairs rules on a preliminary description of the projects' impact (an Environmental Impact Assessment). A negative assessment means no further action is required by the submitting agency. A positive assessment means the project has potential for significant environmental impact, and an Environmental Impact Report is required. Request for an Environmental Authorization triggers this MEPA (Massachusetts Environmental Protection Act) Review.

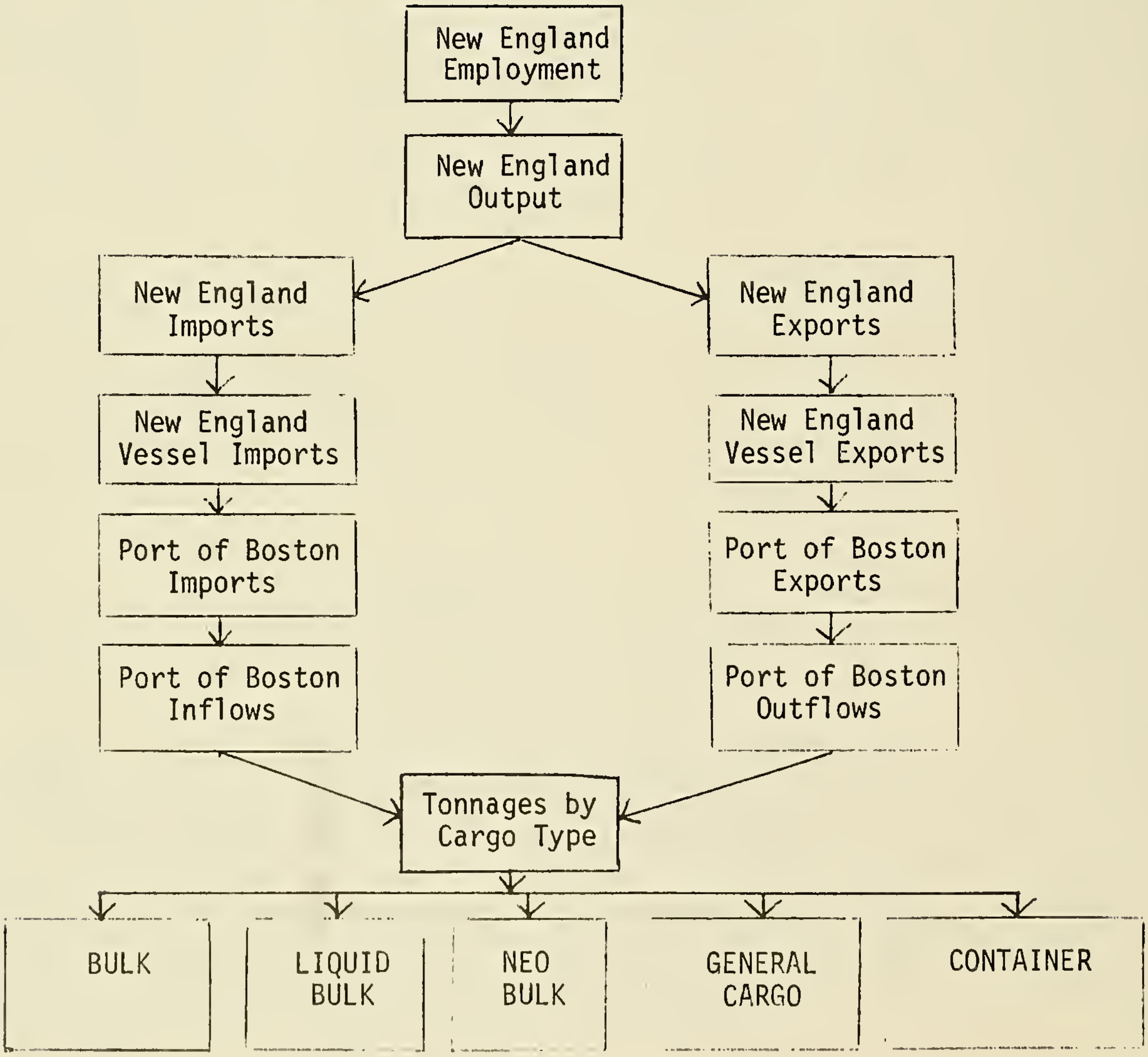
APPENDIX A

METHODOLOGY OF THE DEMAND ANALYSIS

This section presents the specific methods used in the projections of the demand for port facilities at Boston. New England employment forecasts were modified by a string of independently estimated ratios until they yielded estimates of tonnage flows through different port facilities, as illustrated in Figure 1. A discussion of the methods follows.

FIGURE 1

Flow Diagram of Demand Methodology



New England Employment

We looked at four forecasts of New England employment (NPA; Friedlaender et al, 1975; Glantz, 1974; Department of Labor, 1970). Of the models considered, only one, the NPA projected employment for all six New England states to 1990 in appropriately disaggregated sectors (1 digit SIC code for non-manufacturing and 2 digit SIC code for manufacturing). The NPA forecast used a shift share methodology to project New England regional employment.[1] The forecast projected an 18% increase in New England manufacturing employment between 1975 and 1990. This projection did not seem realistic, given that NPA had shown a 10.3% decrease in New England manufacturing employment from 1960 to 1975. There was no reason to expect this trend to reverse itself.

On the other hand, the Massachusetts Econometric Model (Friedlaender et.al.) projected a decrease in manufacturing employment in Massachusetts between 1975 and 1990. The Mass model is an econometric forecasting model which simulates the structural forces affecting employment in Massachusetts. Both models, the NPA and the Mass model, projected very similar total employment for Massachusetts, but there was a different distribution of employment among the sectors of the economy. We had greater confidence in the Mass model's projections and therefore we adjusted the NPA estimate to reflect the Mass model's trends in manufacturing and services employment. We used the same distribution of employment provided by the Mass model to adjust the NPA estimates for the other New England states (at the 1 digit SIC level). This distribution of employment was further adjusted by estimates of state and local government provided by the Massachusetts Office of State Planning (OSP). OSP felt that the Mass model had overstated the employment in that sector and thus we lowered the estimates of state and local government. We also applied this percentage distribution of state and local government to the NPA estimates for New England.

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[1] A limitation of this method is the difficulty of estimating and projecting a region's competitive advantage vis a vis other regions (the shift component). For a more complete discussion of this limitation, see Brown, "Shift and Share Projections of Regional Economic Growth: An Empirical Test", Journal of Regional Science, Vol. 9, #1, 1969.

TABLE 1

New England Employment

(thousands of jobs)

	NPA Unadjusted			NPA Adjusted		
	1980	1985	1990	1980	1985	1990
Agriculture	57.7	49.0	44.5	35.3	31.5	25.9
Mining	5.3	5.6	6.3	5.3	5.6	6.3
Construction	309.2	326.4	338.0	318.2	351.1	359.1
Food and Kindred Products	66.1	62.3	57.5	56.7	51.3	45.6
Textiles	63.9	58.0	51.9	48.4	40.7	32.1
Apparel	75.2	86.0	96.4	63.9	60.1	53.9
Lumber	39.6	37.8	35.3	34.1	32.6	29.2
Furniture	26.3	28.1	29.4	22.1	22.2	20.4
Paper	74.0	78.3	81.2	75.9	83.8	84.1
Printing	82.2	84.7	85.2	81.1	82.7	78.8
Chemicals	42.1	43.8	44.4	39.5	41.3	40.9
Petroleum	1.3	1.1	1.0	1.3	1.1	1.0
Rubber	80.7	79.6	77.2	59.6	56.3	50.2
Leather	57.1	54.3	50.7	58	57.4	51.4
Stone, Glass, Clay	34.7	35.0	34.6	30.3	32.1	32.3
Primary Metals	55.3	54.0	51.8	41	38.7	33.8
Fabricated Metals	141.8	152.0	158.9	113.8	121.3	120.7
Machinery except Electrical	183.2	203.9	222.3	139.7	143.6	136.6
Electrical Equipment	172.5	184.8	193.7	155.5	159.5	149.6
Transportation Equipment	117.2	115.3	111.8	97.4	93.6	85.1
Instruments	72.7	80.5	86.9	73.1	85.2	94.9
Miscellaneous Manufacturing	71.0	74.5	76.4	63.4	64	61.6
Trans., Comm., and Utilities	257.0	277.7	288.5	283.7	302.7	301.1
Wholesale and Retail Trade	1225.0	1391.3	1419.8	1297.7	1414.7	1483.9
Finance, Insurance, Real Estate	325.8	359.2	361.9	326.8	355.5	356.3
Services	1254.0	1440.9	1595.7	1324.9	1561	1743.7
Government	826.9	915.4	964.1	784.7	810.3	832.1
TOTAL	5742.1	6304.6	6590.0	5631.1	6035.8	6323

New England Output/Employment

- Manufacturing:
  - We computed the ratio of output to employment for all New England industries for each 2 digid SIC code for 1967 and 1972, expressed in 1967 dollars (Census of Manufacturing, 1967, 1972). We then took a weighted average of past ratios to arrive at our estimate of output/employment ratios.
- Non-manufacturing:
  - The only available data on the output of these sectors was for 1963 (Polenske, 1972). We took the output/employment ratios for that year and adjusted the ratios to account for changes in productivity (U.S. Department of Labor, 1974).

TABLE 2

Productivity Adjustments

Non-Manufacturing Employment

Average annual percentage change/person-hour, 1958-70	
Agriculture	2.7%
Mining	3.8%
Construction*	2.8%
Transportation, Communication, Utilities**	4.7%
Wholesale and Retail Trade	3.3%
Financial, Insurance, Real Estate*	2.8%
Services*	2.8%
Government	2.0%

* Uses private nonfarm average

** Composed of		
** Composed of	Transportation	4.1%
	Communication	5.4%
	Utilities	4.7%

TABLE 3

New England Output of Goods and Services

(Millions of 1967 constant dollars)

Industry	1966	1969	1971	1972	1980	1986	1990
Agriculture	1,129	1,029	1,004	1,018	934	906	846
Mining	65	69	74	78	138	160	199
Construction	3,682	4,382	4,636	4,631	7,119	8,673	9,793
Food and Kindred Products	2,747	2,824	2,838	2,979	2,520	2,376	2,180
Textiles	1,861	1,719	1,485	1,655	1,024	874	698
Apparel	1,116	1,141	1,158	1,167	977	979	901
Lumber	457	513	550	568	655	664	629
Furniture	338	445	516	551	447	469	451
Paper	1,681	2,222	2,055	2,096	2,375	2,667	2,753
Printing	1,383	1,477	1,458	1,666	1,652	1,741	1,712
Chemicals	1,571	1,694	1,636	1,709	2,013	2,211	2,297
Petroleum	93	98	101	103	117	126	134
Rubber	688	1,470	1,359	1,534	1,348	1,295	1,172
Leather	1,498	1,413	1,136	1,134	981	1,010	936
Stone, Glass and Clay	641	714	751	770	784	865	904
Primary Metals	2,370	2,321	1,881	1,864	1,502	1,442	1,284
Fabricated Metals	2,191	2,304	2,073	2,738	2,611	2,852	2,907
Machinery except Electrical	3,827	3,754	3,211	3,707	3,243	3,416	3,319
Electrical Equipment	3,494	3,950	3,408	4,111	3,286	3,448	3,300
Transportation Equipment	4,043	3,703	2,800	2,649	2,699	2,660	2,484
Instruments	1,420	1,676	1,538	1,756	1,922	2,314	2,660
Miscellaneous Manufacturing	1,300	1,492	1,407	1,557	1,309	1,365	1,353
Trans., Comm., and Utilities	4,879	6,010	6,775	7,131	12,247	14,213	15,345
Wholesale and Retail Trade	8,625	10,596	11,679	12,049	17,760	21,375	24,755
Finance, Insur., Real Estate	8,207	9,993	11,117	11,625	16,968	20,379	22,466
Services	33,099	45,730	50,223	52,017	79,040	102,320	126,910
Government	915	1.113	1,247	1,313	1,787	2,037	2,310
TOTAL	93,416	113,853	118,121	124.176	159,261	193,601	199,503

We trended the output/employment ratios using the productivity adjustments to 1980. After 1980, we did not feel that the projected annual changes in productivity would continue. Therefore, we assumed a 2% yearly increase in productivity over the period from 1980 to 1990.

New England Exports/Output

- Manufacturing:
  - We computed the ratio of the estimated value of exports[2] to output for each 2 digit SIC code for New England for 1966, 1969, 1971, 1972 (U.S. Bureau of Census Survey of the Origins of the Exports of Manufactured Products). These ratios were then averaged and the resulting ratios applied to the output projections previously generated.[3]

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[2] The Survey included two export figures for each category: reported and estimated. The reported figures represented total values actually recorded by the repondents; these counted for about 71% of the total exports. These figures were then inflated to include smaller manufacturers (250 employees or total exports $25,000) and shipments exported by wholesalers. These figures were termed estimated.

[3] The approach described above was determined to be the most feasible after a lengthy search for appropriate data. The following list indicates some of the other data sources which were examined but for one or more reasons were discarded for lack of relevance.

U.S. Census of Transportation - Commodities
U.S. Census of Foreign Trade - Imports and Exports
Highlights of U.S. Foreign Trade
U.S. Army Corps of Engineers - Waterborne Commerce in the U.S.
Domestic & International Transportation of U.S. Foreign Trade 1970
Journal of Commerce data

Some of the problems encountered with the above sources which rendered them inadequate for this study are briefly sketched below.

The U.S. Census of Foreign Trade organizes the origins and destinations of exports and imports nationally rather than regionally.

The Highlights of U.S. Foreign Trade records the data by customs districts instead of by states or regions.

The U.S. Army Corps data lists exports and imports by ports without indicating origins and destinations.

U.S. Transportation Census data represents intercity movements within the U.S. which are greater than 25 miles (exception - Appendix G 1967).

The U.S. Foreign Trade commodity groupings differ from SIC categories.

TABLE 4

New England Manufacturing

Output and Exports of Goods

(Millions of 1967 dollars)

	1966			1969			1971			1972			Four Year Average
	Output	Exports	Exports/Output	Output	Exports	Exports/Output	Output	Exports	Exports/Output	Output	Exports	Exports/Output	
Food & Kindred Prods.	2742.2	46.9	.017	2824.0	44.8	.016	2837.6	53.2	.019	2978.8	56.1	.019	.0177
Textiles	1861.1	51.6	.027	1718.8	37.1	.022	1485.2			1654.9			.0247
Apparel	1115.8	12.2	.0109							1166.8			.0109
Lumber	4569		.0311							568.2			.0311
Furniture	338.2	3.0	.0089							551.2			.0089
Paper	1680.5	44.2	.026	2221.5	62.4	.028	2055.2	79.2	.039	2095.5	87.7	.042	.0337
Printing	1382.9	15.6	.0113	1476.8	15.8	.0107	1457.7			1666.3	14.8	.008	.0103
Chemicals	1571.1	67.2	.043	1693.8	80.7	.048	1635.9	92.1	.056	1709.3	89.0	.052	.0356
Rubber	687.7	40.0	.058	1469.9	34.4	.023	1359.2	32.5	.024	1533.6	34.6	.073	.032
Leather	1497.7	20.7	.014	1412.5	20.5	.015	1136.2	14.4	.013	1133.7	19.7	.017	.0146
Stone, Glass, Clay	640.9	22.6	.035	713.5	23.1	.0324		22.0		770.1	17.3	.0225	.03
Primary Metals	2369.9	35.1	.015	2321.1	45.9	.020	1881.4	36.6	.019	1862.9	44.7	.024	.0195
Fabricated Metals	2190.7	76.6	.035	2303.8	63.0	.027	2073.2	50.6	.024	2738.2	59.3	.022	.027
Machinery ex. Elec.	3826.9	346.8	.09	3754.4	380.9	.101	3210.6	407.2	.127	3706.9	419.4	.113	.108
Electrical Equip.	3493.9	156.6	.045	3949.7	221.8	.056	3408.3	185.6	.054	4110.7	222.1	.054	.052
Transport. Equip.	4043.4	177.7	.044	3707.9	307.7	.083	2800.4	427.9	.157	2649.3	402.2	.15	.107
Instruments	1419.8	129.3	.091	1676.4	170.0	.101	1538.2	172.0	.11	1755.7	186.7	.10	.103
Misc. Manufacturing	1300.1	119.5	.077	1491.9	114.5	.05	1401.8	124.3	.07	1556.9	153.4	.035	.075

- Agriculture and Mining:
  - Data were not available to allow direct estimation of the exports of the non-manufacturing sectors of New England. Exports were therefore estimated directly for the Port of Boston. We will discuss this procedure in the section on inflows and outflows through the Port.

New England Imports/Output

Data on imports organized other than nationally were severely limited. Most data were available only by port of entry, and thus did not provide the final destination of imports. New York, for example, receives imports which are then transported to other states. We were interested in counting all imports, regardless of the port of entry, which had New England as a final destination.

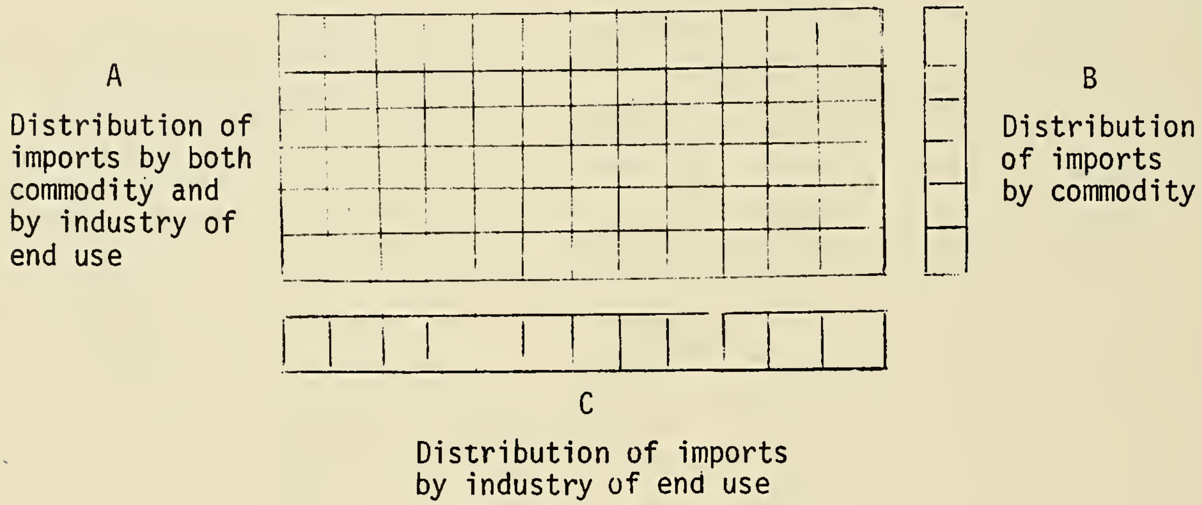
Given the limitations of regional data on imports, we decided to rely on national figures, and to adjust them to reflect the New England economy. We used the 1963 Input-Output table of direct requirements per dollar of gross output (Survey of Current Business, 11/1969) to provide us with the basis for our estimates. Row 80 of the table gave us the amount of imports required by each sector in order to produce one dollar of output. We also needed to know the commodity distribution of these imports. Since these data were not available, we assumed that the commodity mix of a sector's imports was similar to the goods used in the production of that sector's output. This information was contained in the Input-Output table as well. We reduced this table into a 22 commodity by 78 sector version to match our commodity classification scheme (2 digit manufacutring SIC codes, agriculture and mining).

This gave us, for each sector, the proportion of each commodity that had to be imported to produce one dollar of output. By multiplying these requirements by New England output in each sector, we obtained estimates of the total import requirements for each sector.

Since this 22 by 78 table was based on national data, using it in this state would introduce some biases into the estimates of New England imports. For example, New England imports more petroleum as a proportion of all imports than the nation as a whole. We wanted the import requirements to reflect the actual distribution of commodities imported by New England. We therefore assumed that the mix of commodities imported the ports of New York and Boston combined would approximate the actual distribution of commodities in 1963 (Waterborne Commerce). This provided a commodity distribution of all New England imports, which we then adjusted to reflect our estimates of total New England imports. We then used iterative scaling techniques (Y.M.M. Bishop, "Full Contingency Tables, Logits, and Split Contingency Tables," Biometrics, 25 (1967)) to adjust the commodity import distributions by sector (A-Figure 2) to match both the total distribution of commodities imported (B-Figure 2) and the distribution of total imports by sector (C-Figure 2).

FIGURE 2

Diagram Illustrating Adjustment of Commodity Imports


A
Distribution of imports by both commodity and by industry of end use
B
Distribution of imports by commodity
C
Distribution of imports by industry of end use

Imports and Exports by Vessel

At this point we have estimates of the imports and exports generated by the sectors of economic activity in New England. Since we are concerned only with waterborne movements, we need to eliminate all airborne imports and exports from our analysis. We therefore computed the proportion of cargo that was imported and exported by vessel from New England divided by the total imports and exports of the region.

We utilized the U.S. Census publication, Domestic & International Transportation of U.S. Foreign Trade 1970, to derive these ratios. It

TABLE 5A

Projections of New England Vessel Exports of Manufactured Products

(in millions of 1967 dollars)

Commodities	1980	1985	1990
Food and Kindred Products	44.60	42.04	38.59
Textiles	24.81	21.59	17.24
Apparel	10.65	10.67	9.82
Lumber	20.36	20.64	19.57
Furniture	3.98	4.17	4.01
Paper	80.03	89.89	92.78
Printing	17.01	17.93	17.63
Chemicals	71.67	78.7	81.77
Rubber	43.14	41.43	37.49
Leather	14.32	14.75	13.67
Stone, Glass, Clay	23.53	25.94	27.12
Primary Metals	29.28	28.10	25.03
Fabricated Metals	70.5	77.01	78.48
Machinery except Electrical	350.23	368.90	358.48
Electrical Equipment	170.88	179.29	171.61
Transportation Equipment	288.75	284.61	265.80
Instruments	197.93	238.35	273.95
Miscellaneous Manufacturing	134.86	140.58	139.40
TOTAL	1596.53	1684.59	1672.44

TABLE 5B

Projections of New England Vessel Imports

(in millions of 1967 dollars)

Commodities	1980	1985	1990
Agriculture	143.57	141.46	135.45
Mining	31.8	35.33	37.51
Food and Kindred Products	128.07	141.01	151.26
Textiles	37.59	36.56	33.93
Apparel	19.54	21.2	21.94
Lumber	37.39	42.82	45.89
Furniture	4.65	5.28	5.62
Paper	70.64	80.38	87.33
Printing	84.57	107.86	130.81
Chemicals	177.1	212.58	243.91
Petroleum	94.83	113.67	130.23
Rubber	46.15	52.35	56.41
Leather	23.50	24.71	23.69
Stone, Glass, Clay	48.46	56.28	61.68
Primary Metals	145.87	155.52	155.44
Fabricated Metals	91.11	102.32	108.38
Machinery except Electrical	68.28	74.46	76.43
Electrical Equipment	78.73	88.41	93.5
Transportation Equipment	61.55	66.67	68.72
Instruments	59.35	74.61	89.24
Miscellaneous Manufacturing	23.05	27.34	31.01
TOTAL	1,475.97	1,650.99	1,787.98

contained data on the distribution of vessel and air imports and exports by eight commodity groupings for the ports of Boston and New York. Since these are the major ports through which New England's cargo is shipped, we weight averaged these two sets of ratios to obtain estimates of the proportions of imports and exports that are transported by vessel and applied these to our ratios of exports and imports over output.

Dollars to Tonnage Conversions

We developed factors for converting the dollar values of imported and exported commodities using census data (General Imports, 1968 and U.S. Exports of Domestic Merchandise, 1969). After applying these conversion factors to our estimates of imports and exports, we obtained tonnage estimates of New England vessel imports and exports.

Capture Ratio

The previous steps produced estimates of New England's waterborne imports and exports. We then estimated the proportion of these shipments that passed through the Port of Boston (Waterborne Commerce, 1966, 1969, 1971, 1972) to our estimates of New England waterborne imports and exports for those years for each of our twenty-two commodity codes.

The next question was how to project these capture ratios into the future. We first tried trending them using a simple linear regression model with capture ratio as our dependent variable and time as our independent variable. This process yielded future ratios greater than one for some commodities and less than zero for others. While it is conceivable that some capture ratios for particular years might be greater than one (and in fact this is the case with some of our data), it is impossible for a capture ratio to ever be less than zero. We recognized the problem to be caused by attempting to project far beyond the range of our data. The standard errors of our regression coefficients were so large that we could have little or no confidence in the projected capture ratios. Consequently we decided to average the ratios for each commodity for the past four years and apply the result to our projections.

This average was the basis for our "low" estimate of Boston's capture. It is low because the data indicated that capture ratios were

TABLE 6A

New England Vessel Exports of Manufactured Products

(in thousands of tons)

Commodities	1966	1969	1971	1972	1980	1985	1990
Food and Kindred Products	288	275	326	344	276	260	239
Textiles	30	21	18	21	15	13	10
Apparel	3	3	3	3	3	3	3
Lumber	662	760	794	824	950	963	913
Furniture	2	3	3	3	3	3	3
Paper	282	415	526	580	533	598	618
Printing	8	8	7	8	9	10	9
Chemicals	252	303	346	334	274	300	312
Rubber	33	28	26	28	35	34	31
Leather	13	13	9	13	10	10	9
Stone, Glass, Clay	57	58	56	44	62	68	72
Primary Metals	104	136	108	132	90	87	77
Fabricated Metals	69	57	46	54	66	72	74
Machinery except Electrical	118	129	136	142	154	163	158
Electrical Equipment	45	64	53	64	64	67	64
Transportation Equipment	87	151	208	198	185	182	170
Instruments	20	26	26	28	35	42	48
TOTAL	2,073	2,450	2,691	2,820	2,763	2,875	2,810

TABLE 6B

New England Vessel Imports

(in thousands of tons)

Commodities	1966	1969	1971	1972	1980	1985	1990
Agriculture	360	363	362	377	342	336	322
Mining	7,066	7,490	7,319	7,463	8,826	9,806	10,413
Food and Kindred Products	411	432	434	451	480	529	567
Textiles	89	89	82	87	68	66	60
Apparel	22	22	22	23	22	24	25
Lumber	329	348	389	402	502	574	616
Furniture	5	5	5	5	6	7	7
Paper	551	534	636	674	781	889	966
Printing	306	361	395	411	601	766	929
Chemicals	703	800	820	863	1,089	1,307	1,499
Petroleum	2,395	2,802	3,018	3,139	4,617	5,534	6,340
Rubber	121	132	126	134	150	170	183
Leather	18	17	14	14	12	13	13
Stone, Glass, Clay	247	278	282	296	366	425	466
Primary Metals	367	380	329	365	349	372	371
Fabricated Metals	170	183	176	190	212	238	252
Machinery except Electrical	37	37	33	36	37	40	41
Electrical Equipment	32	35	32	35	40	42	44
Transportation Equipment	48	51	42	43	50	54	56
Instruments	7	9	9	9	13	16	19
Miscellaneous Manufacturing	9	10	10	11	12	15	17
TOTAL	13,293	14,378	14,535	15,028	18,575	21,223	23,206

improving over time and so an average tends to understate this improvement. Also, the capture of commodities that are highly containerized will be very low before 1971 since there was limited container capacity in Boston. However, to ignore the data from 1966 and 1969 would have left us with only two data points, 1971 and 1972, and we were very reluctant to make projections based on only two data points.

We also estimated a "most likely" and a "high" capture ratio. The most likely estimate reflected an improved capture of those specific commodities that are highly containerized. This seemed reasonable because of the improved trends after 1972 due to Massport's increased marketing efforts. Therefore, we increased the low capture ratio for imports by 25% and for exports by 60%[4]

Our high estimates assumed an even greater improvement in Massport's ability to attract New England shipping. We raised our capture ratios on exports such that the port handled as much export container tonnage in 1980, 1985 and 1990 as it had in 1974, its best year ever. This was an optimistic assumption since we have projected a stabilization of exports in the future. We felt that for Massport to handle 300,000 tons of container exports again would be as high an estimate as we could justify. We increased our capture ratio on containerizable imports by 57% over the low estimate. These high estimates reflected our views on Massport's best attempts to capture vessel traffic to and from New England.

Projecting Inflows and Outflows through the Port of Boston

Inflows and outflows through the port of Boston consist of foreign imports, foreign exports and coastwise shipments and receipts. We estimated each of these flows through the port of Boston separately.

Imports

We multipled the different capture ratios for imports of each com-

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[4] It should be pointed out that this percent increase in exports is not as large as it seems since it is a percent increase on a very small base for many commodities. With this improved capture ratio, Boston is still getting only 5% of the New England exports in certain commodities.

TABLE 7

Capture Ratios for Port of Boston

Commodity	Foreign Imports			Foreign Exports		
	Low	Most Likely	High	Low	Most Likely	High
Food and Kindred Products	1.37	1.37	1.37	.17	.206	.263
Textiles	.38	.47	.59	.09	.142	.228
Apparel	.09	.12	.15	.016	.025	.04
Lumber	.30	.33	.39	.001	.001	.001
Furniture	.61	.71	.96	.034	.054	.087
Paper	.06	.08	.12	.031	.05	.079
Printing	.002	.003	.003	.05	.08	.128
Chemicals	.05	.05	.06	.03	.048	.077
Rubber	.04	.05	.06	.028	.045	.072
Leather	2.08	2.08	2.08	.59	1.0	1.0
Stone	.13	.13	.13	.03	.048	.077
Primary Metals	.49	.51	.53	.015	.024	.038
Fabricated Metals	.18	.23	.29	.021	.034	.054
Machinery except Electrical	.46	.58	.73	.042	.067	.107
Electrical Equipment	.23	.29	.36	.026	.042	.066
Transportation Equipment	1.06	1.06	1.06	.003	.005	.008
Instruments	.09	.12	.15	.047	.075	.12
Miscellaneous Manufacturing*	1.36	1.36	1.36			
Agriculture*	.21	.22	.23			
Mining*	.06	.06	.06			
Petroleum*	2.19	2.19	2.19			

* Data was not available to compute capture ratios on these commodities for foreign exports. Tonnages through the port were assumed to increase 10% for most likely capture and 20% for high capture (over low capture ratio).

modity by our projections of New England vessel imports. Using each of our estimates of capture ratio, this gave us three estimates of import tonnages through Boston in the future.

Exports

Manufacturing - We multiplied each of our capture ratios for manufactured commodities by our projections of New England vessel exports.

Agriculture and Mining - There were no data available on the vessel imports generated by these sectors. Therefore, we estimated the exports of these sectors through the Port of Boston as a percentage of the New England output of each sector. Specifically, we computed past ratios of vessel exports through Boston to New England output for agriculture and mining for 1966, 1969, 1971 and 1972 (Waterborne Commerce). We then calculated an average ratio from the past data for each commodity and multiplied this ratio by our projections of future output to obtain export projections of agriculuture and mining products through the Port of Boston.

Scrap and Waste Products - We projected the exports of iron and steel scrap, nonferrous scrap, textile scrap and paper waste as a function of consumer spending.[5] Using past data on New England personal consumption expenditures (NPA, 1966, 1969, 1971, 1972) and Boston data on scrap exports (Waterborne Commerce, 1966, 1969, 1971, 1972), we calculated an average ratio of scrap exports through the Port of Boston to New England personal consumption expenditures. We then multiplied this ratio by NPA's projections of personal consumption expenditures in 1980, 1985 and 1990.

Coastwise Shipments and Receipts

There were no data available on New England's coastwise shipping in the past. Therefore, we linked imports and coastwise receipts (both inflows) and exports and coastwise shipments (both outflows). We

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[5] We would have preferred to project scrap as a function of state gross product. This would have more accurately measured the generation of scrap by both consumers and industry. However, these data were not available.

TABLE 8

Foreign Imports and Exports through Port of Boston

(in tons)*

Commodities	Imports			Exports		
	1980					
	Low	Most Likely	High	Low	Most Likely	High
Agriculture	70,500	74,000	77,400	4,700	5,200	5,700
Mining	523,000	523,000	523,000	8,400	9,200	10,100
Durable Manufacturing	534,800	583,800	654,200	16,300	25,500	40,000
Nondurable Manufacturing	820,000	845,600	893,700	80,700	110,900	152,600
Petroleum	10,120,200	10,120,200	10,120,200	3,400	3,800	4,100
Scrap	9,700	9,700	9,700	681,700	681,700	681,700
	1985					
Agriculture	69,500	72,900	76,300	4,600	5,100	5,500
Mining	581,000	581,000	581,000	9,800	10,800	11,700
Durable Manufacturing	595,100	639,500	724,800	17,300	27,100	41,700
Nondurable Manufacturing	905,100	934,400	987,700	80,800	112,200	155,500
Petroleum	12,130,300	12,130,300	12,130,300	3,700	4,100	4,400
Scrap	8,300	8,300	8,300	836,800	836,800	836,800
	1990					
Agriculture	66,500	69,900	73,100	4,300	4,700	5,100
Mining	616,900	616,900	616,900	12,100	13,400	14,600
Durable Manufacturing	617,400	663,000	755,400	17,200	27,000	42,400
Nondurable Manufacturing	969,500	1,000,000	1,020,600	77,300	108,100	150,700
Petroleum	13,897,100	13,897,100	13,897,100	3,900	4,300	4,700
Scrap	6,600	6,600	6,600	926,300	926,300	926,300

* rounded to nearest hundred

TABLE 9A

Ratio of Foreign Imports to Coastwise Receipts
Port of Boston

Commodities	Ratio
Agriculture	10.67
Mining	11.70
Food and Kindred Products	15.22
Tobacco	12.0
Textiles	39.56
Apparel	4.215
Lumber	151.99
Furniture	8.09
Paper	6.88
Printing	1.60
Chemicals	.64
Petroleum	.50
Rubber	4.46
Leather	4.3
Stone, Glass, Clay	.078
Primary Metals	41.88
Fabricated Metals	38.06
Machinery except Electrical	11.74
Electrical Equipment	6.09
Transportation Equipment	117.52
Instruments	161.36
Miscellaneous Manufacturing	26.35
Iron and Steel Scrap	-
Nonferrous Scrap	.70
Textile Scrap	-
Commodities (NEC) (not elsewhere classified)	.011

TABLE 9B

Ratio of Foreign Exports to Coastwise Shipments
Port of Boston

Commodities	Ratio
Agriculture	.308
Mining	4.33
Food and Kindred Products	2.98
Tobacco	2.7
Textile	3.42
Apparel	.513
Lumber	1.18
Furniture	.365
Paper	2.81
Printing	.708
Chemicals	.856
Petroleum	4.68*
Rubber	.573
Leather	2.37
Stone, Glass, Clay	1.00
Primary Metals	.586
Fabricated Metals	.445
Machinery except Electrical	5.13
Electrical Equipment	3.47
Transportation Equipment	6.11
Instruments	8.59
Miscellaneous Manufacturing	.597
Iron and Steel Scrap	-
Nonferrous Scrap	2.06
Textile Scrap	-
Waste-Paper Scrap	
Commodities (NEC) (not elsewhere classified)	.0031

* (ratio for petroleum is imports/shipments)

computed past ratios of coastwise receipts to imports and coastwise shipments to exports for the Port of Boston for 1971, 1972, 1973 and 1974 (Waterborne Commerce) for each of our twenty-two commodity types. We then averaged these ratios and applied them to our projections of imports and exports through the Port to obtain estimates of total inflows and outflows through the Port. For petroleum, however, most of the coastwise shipments consisted of petroleum products previouly imported into Boston. Therefore, we projected petroleum coastwise shipments by taking the average of past ratios of coastwise shipments to imports, and multiplied them by our projections of Boston petroleum imports.

Assigning Commodities to Cargo Type

At this point, we had projections of tonnages of inflows and outflows through the Port by commodity type. It was necessary, for purposes of facility planning, to allocate these tonnages to the type of cargo handling facility that processed them. We considered five types of cargo in this allocation:

Bulk
Neo-bulk
Liquid bulk
General cargo
Container cargo

We then identified the cargo type of the commodities (see Appendix B for classification scheme). In cases of commodities involving more than one kind of cargo, we made the assignments based on the past mix of cargo types at the Port of Boston (Waterborne Commerce, 1973, 1974).

Recommendations For Extending the Demand Analysis

Throughout the estimation of demand, we experienced severe data limitations. We have some ideas on possible sources of improved data and on appropriate methods for using this data.

- Estimating Capture Ratio

We had intended to use a regression model for estimating Boston's capture ratio for New England's inflows and outflows. This model would relate the shipper's port choice (or the port's capture ratio) to three components of shipping costs: inland transportation costs, port costs, and waterborne costs. Inland transportation costs could be operationalized

TABLE 10

Inflows and Outflows through Port of Boston

(in tons)*

Commodities	Inflows			Outflows		
	Low	Most Likely	High	Low	Most Likely	High
			1980			
Agriculture	77,100	81,000	84,700	20,000	22,100	24,100
Mining	565,000	565,000	565,000	10,300	11,400	12,400
Durable Manufacturing	1,143,300	1,193,900	1,266,100	47,600	64,800	90,900
Nondurable Manufacturing	961,600	998,200	1,055,400	117,400	163,600	227,900
Petroleum	30,360,500	30,360,500	30,360,500	2,165,900	2,166,200	2,166,500
Scrap	9,700	9,700	9,700	686,000	686,000	686,000
			1985			
Agriculture	76,000	79,800	83,500	19,500	21,500	23,400
Mining	628,000	628,000	628,000	12,000	13,200	14,400
Durable Manufacturing	1,306,200	1,353,400	1,434,700	50,000	68,300	95,600
Nondurable Manufacturing	1,070,800	1,110,700	1,175,400	118,200	166,400	233,600
Petroleum	35,390,800	36,390,800	36,390,800	2,595,600	2,596,000	2,596,400
Scrap	8,300	8,300	8,300	840,300	840,300	840,300
			1990			
Agriculture	72,800	76,400	79,900	18,200	20,000	21,900
Mining	666,000	666,000	666,000	15,000	16,400	17,900
Durable Manufacturing	1,390,600	1,447,900	1,533,000	49,300	67,400	94,500
Nondurable Manufacturing	1,152,900	1,197,300	1,272,800	113,700	161,100	221,400
Petroleum	41,691,300	41,691,300	41,691,300	2,973,400	2,973,800	2,974,200
Scrap	6,600	6,600	6,600	930,200	930,200	930,200

* rounded off to nearest hundred

TABLE 11A
Low Estimate - Boston Inflows - 1980
(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	45,501	30,848	771		
Mining			448,451		119,208
Food and Kindred Products	112,492		5,625		583,552
Tobacco	52				
Textiles	26,151				
Apparel	2,575				
Lumber	5,969			143,252	
Furniture	4,181				
Paper	51,717			1,599	
Printing	2,051				
Chemicals	89,535		39,341		6,783
Petroleum					30,360,534
Rubber	6,819				
Leather	31,888				
Stone, Glass, Clay	19,344		625,466		
Primary Metals	20,888	1,741		151,437	
Fabricated Metals	39,941				
Machinery except Electrical	18,294				
Electrical Equipment	9,939				
Transportation Equipment	8,552			44,901	
Instruments	1,189				
Miscellaneous Manufacturing	17,521				
Iron and Steel Scrap		78			
Nonferrous Scrap	-				
Textile Scrap	9,604				
Commodities (NEC) (not elsewhere classified)	30,664				
TOTAL	554,867	32,667	1,119,654	341,189	31,070,077

TABLE 11A

Low Estimate - Boston Inflows - 1985

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	44,832	30,395	760		
Mining			498,226		132,440
Food and Kindred Products	123,859		6,193		642,516
Tobacco	50				
Textiles	25,437				
Apparel	2,794				
Lumber	6,835			164,044	
Furniture	4,744				
Paper	59,819			1,850	
Printing	2,615				
Chemicals	107,472		47,223		8,142
Petroleum					36,390,819
Rubber	7,733				
Leather	33,527				
Stone, Glass, Clay	22,467		726,425		
Primary Metals	22,270	1,856		161,455	
Fabricated Metals	44,886				
Machinery except Electrical	20,137				
Electrical Equipment	14,598				
Transportation Equipment	9,967			52,329	
Instruments	1,495				
Miscellaneous Manufacturing	20,786				
Iron and Steel Scrap		75			
Nonferrous Scrap					
Textile Scrap	8,194				
Commodities (NEC) (not elsewhere classified)	31,936				
TOTAL	594,183	32,326	1,278,827	379,678	37,173,917

TABLE 11A

Low Estimate - Boston Inflows - 1990

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	42,928	29,104	728		
Mining			529,040		140,631
Food and Kindred Products	132,856		6,643		689,189
Tobacco	47				
Textiles	23,234				
Apparel	2,890				
Lumber	7,326			175,815	
Furniture	5,052				
Paper	63,934			1,977	
Printing	3,172				
Chemicals	123,376		54,211		9,347
Petroleum					41,691,255
Rubber	8,334				
Leather	32,145				
Stone, Glass, Clay	24,619		796,015		
Primary Metals	22,259	1,855		161,381	
Fabricated Metals	47,513				
Machinery except Electrical	20,668				
Electrical Equipment	11,805				
Transportation Equipment	9,549			50,130	
Instruments	1,788				
Miscellaneous Manufacturing	23,572				
Iron and Steel Scrap		67			
Nonferrous Scrap					
Textile Scrap	6,544				
Commodities (NEC) (not elsewhere classified)	31,256				
TOTAL	644,867	31,026	1,386,637	389,303	42,530,422

TABLE 11A

Low Estimate - Boston Outflows - 1980

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	4,803	15,211			
Mining	4,540	1,445	4,334		
Food & Kindred Prods.	17,742	3,485	317		41,821
Tobacco	30				
Textiles	1,712				
Apparel	133				
Lumber	509			1,246	
Furniture	385				
Paper	21,719			672	
Printing	1,105				
Chemicals	15,655	125	445		1,601
Petroleum					2,165,863
Rubber	2,701				
Leather	8,138				
Stone, Glass, Clay	3,728				
Primary Metals	2,347		73	1,247	
Fabricated Metals	4,504				
Machinery except Elect.	7,748				
Electrical Equipment	2,142				
Transportation Equipment	645				
Instruments	1,835				
Misc. Manufacturing	736				
Iron & Steel Scrap		667,442			
Nonferrous Scrap	5,082				
Textile Scrap	10,523				
Waste-Paper Scrap	2,941				
Commodities (NEC)	20,442				
TOTAL	141,845	687,708	5,169	3,165	2,209,285

TABLE 11A

Low Estimate - Boston Outflows - 1985

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	4,680	14,821			
Mining	5,297	1,685	5,056		
Food & Kindred Prods.	16,724	3,285	299		39,420
Tobacco	23				
Textiles	1,490				
Apparel	133				
Lumber	516			1,263	
Furniture	404				
Paper	24,396			756	
Printing	1,165				
Chemicals	17,192	137	488		1,758
Petroleum					2,595,626
Rubber	2,594				
Leather	8,382				
Stone, Glass, Clay	4,110				
Primary Metals	2,252		70	1,196	
Fabricated Metals	4,919				
Machinery except Elect.	8,161				
Electrical Equipment	2,248				
Transportation Equipment	635				
Instruments	2,211				
Misc. Manufacturing	768				
Iron & Steel Scrap		819,240			
Nonferrous Scrap	6,230				
Textile Scrap	11,231				
Waste-Paper Scrap	3,610				
Commodities (NEC)	21,231				
TOTAL	150,662	839,168	5,913	3,215	2,636,804

TABLE 11A

Low Estimate - Boston Outflows - 1990

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	4,374	13,849			
Mining	6,578	2,093	6,279		
Food & Kindred Prods.	15,352	3,015	274		36,186
Tobacco	15				
Textiles	1,190				
Apparel	121				
Lumber	489			1,198	
Furniture	389				
Paper	25,179			779	
Printing	1,146				
Chemicals	17,863	142	507		1,827
Petroleum					2,973,405
Rubber	2,347				
Leather	7,769				
Stone, Glass, Clay	4,296				
Primary Metals	2,006		63	1,066	
Fabricated Metals	5,014				
Machinery except Elect.	7,931				
Electrical Equipment	2,151				
Transportation Equipment	593				
Instruments	2,541				
Misc. Manufacturing	760				
Iron & Steel Scrap		906,873			
Nonferrous Scrap	6,890				
Textile Scrap	12,432				
Waste-Paper Scrap	3,996				
Commodities (NEC)	20,838				
TOTAL	152,250	925,972	7,123	3,043	3,011,418

TABLE 11B

Most Likely Estimate - Boston Inflows - 1980

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	47,775	32,390	810		
Mining			446,558		118,705
Food & Kindred Prods.	112,492		7,030		583,552
Tobacco	65				
Textiles	32,567				
Apparel	3,226				
Lumber	6,565			157,553	
Furniture	5,225				
Paper	65,079			2,013	
Printing	2,538				
Chemicals	98,512		43,286		7,463
Petroleum					30,360,534
Rubber	8,530				
Leather	31,888				
Stone, Glass, Clay	19,344		625,466		
Primary Metals	21,927	1,827		158,967	
Fabricated Metals	50,077				
Machinery except Elect.	23,286				
Electrical Equipment	12,491				
Transportation Equipment	8,552			44,901	
Instruments	1,490				
Misc. Manufacturing	17,521				
Iron & Steel Scrap		78			
Textile Scrap	9,604				
Commodities (NEC)	38,664				
TOTAL	617,418	34,295	1,123,150	363,434	31,070,254

TABLE 11B

Most Likely Estimate - Boston Inflows - 1985

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	47,073	31,914	798		
Mining			496,124		131,881
Food & Kindred Prods.	123,859		7,741		642,516
Tobacco	62				
Textiles	31,678				
Apparel	2,900				
Lumber	7,517			180,420	
Furniture	5,928				
Paper	74,053			2,290	
Printing	3,237				
Chemicals	118,246		51,956		8,958
Petroleum					36,390,819
Rubber	9,675				
Leather	33,527				
Stone, Glass, Clay	22,467		726,425		
Primary Metals	23,377	1,948		169,481	
Fabricated Metals	56,239				
Machinery except Elect.	25,129				
Electrical Equipment	14,029				
Transportation Equipment	9,967			52,329	
Instruments	1,874				
Misc. Manufacturing	20,786				
Iron & Steel Scrap		75			
Textile Scrap	8,194				
Commodities (NEC)	39,920				
TOTAL	679,737	33,937	1,283,044	404,520	37,174.174

TABLE 11B

Most Likely Estimate - Boston Inflows - 1990

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	45,072	30,558	764		
Mining			526,808		140,038
Food & Kindred Prods.	132,856		8,303		689,189
Tobacco	59				
Textiles	28,934				
Apparel	3,001				
Lumber	8,057			193,368	
Furniture	6,314				
Paper	80,455			2,488	
Printing	3,926				
Chemicals	135,674		59,614		10,278
Petroleum					41,691,255
Rubber	10,425				
Leather	32,145				
Stone, Glass, Clay	24,619		796,015		
Primary Metals	23,365	1,947		169,404	
Fabricated Metals	59,571				
Machinery except Elect.	25,794				
Electrical Equipment	14,835				
Transportation Equipment	9,549			50,130	
Instruments	2,241				
Misc. Manufacturing	23,572				
Iron & Steel Scrap		67			
Textile Scrap	6,544				
Commodities (NEC)	39,070				
TOTAL	716,079	32,572	1,391,504	415,390	42,530,760

TABLE 11B

Most Likely Estimate - Boston Outflows - 1980

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	5,307	16,806			
Mining	4,994	1,589	4,767		
Food & Kindred Prods.	28,215	5,547	514		41,821
Tobacco	33				
Textiles	2,739				
Apparel	209				
Lumber	560			1,371	
Furniture	610				
Paper	35,032			1,083	
Printing	1,768				
Chemicals	25,048	199	712		2,562
Petroleum					2,166,206
Rubber	4,343				
Leather	13,817				
Stone, Glass, Clay	5,964				
Primary Metals	3,756		117	1,995	
Fabricated Metals	7,290				
Machinery except Elect.	12,360				
Electrical Equipment	3,461				
Transportation Equipment	1,074				
Instruments	2,929				
Misc. Manufacturing	811				
Iron & Steel Scrap		667,442			
Nonferrous Scrap	5,082				
Textile Scrap	10,523				
Waste-Paper Scrap	2,941				
Commodities (NEC)	22,436				
TOTAL	201,352	691,583	6,110	4,449	2,210,589

TABLE 11B

Most Likely Estimate - Boston Outflows - 1985

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	5,148	16,302			
Mining	5,827	1,854	5,562		
Food & Kindred Prods.	26,595	5,229	484		39,420
Tobacco	26				
Textiles	2,384				
Apparel	209				
Lumber	567			1,389	
Furniture	639				
Paper	39,347			1,217	
Printing	1,862				
Chemicals	27,506	219	781		2,813
Petroleum					2,595,995
Rubber	4,170				
Leather	14,231				
Stone, Glass, Clay	6,574				
Primary Metals	3,603		113	1,914	
Fabricated Metals	7,962				
Machinery except Elect.	13,020				
Electrical Equipment	3,631				
Transportation Equipment	1,059				
Instruments	3,528				
Misc Manufacturing	845				
Iron & Steel Scrap		819,240			
Nonferrous Scrap	5,230				
Textile Scrap	21,291				
Waste-Paper Scrap	3,610				
Commodities (NEC)	23,420				
TOTAL	223,284	839,469	6,910	4,520	2,638,228

TABLE 11B

Most Likely Estimate - Boston Outflows - 1990

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	4,811	15,234			
Mining	7,236	2,302	6,907		
Food & Kindred Prods.	24,413	4,800	444		36,186
Tobacco	16				
Textiles	1,903				
Apparel	192				
Lumber	538			1,317	
Furniture	617				
Paper	40,612			1,256	
Printing	1,831				
Chemicals	28,579	227	812		2,923
Petroleum					2,973,799
Rubber	3,772				
Leather	13,190				
Stone, Glass, Clay	6,874				
Primary Metals	3,210		100	1,705	
Fabricated Metals	8,115				
Machinery except Elect.	12,653				
Electrical Equipment	3,476				
Transportation Equipment	989				
Instruments	4,055				
Misc. Manufacturing	835				
Iron & Steel Scrap		906,873			
Nonferrous Scrap	6,890				
Textile Scrap	12,432				
Waste-Paper Scrap	3,996				
Commodities (NEC)	22,922				
TOTAL	214,157	929,436	8,263	4,278	3,012,908

TABLE 11C

High Estimate - Boston Inflows - 1980

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	49,988	33,890	847		
Mining			445,953		118,544
Food and Kindred Prods.	112,492		7,031		583,552
Tobacco	81				
Textiles	41,079				
Apparel	4,039				
Lumber	7,881			189,143	
Furniture	6,564				
Paper	106,598			2,522	
Printing	3,222				
Chemicals	103,116		45,308		7,812
Petroleum					30,360,534
Rubber	9,175				
Leather	31,888				
Stone, Glass, Clay	19,344		625,466		
Primary Metals	23,000	1,917		166,749	
Fabricated Metals	62,689				
Machinery except Elect.	28,999				
Electrical Equipment	15,503				
Transportation Equipment	8,552			44,900	
Instruments	1,871				
Misc. Manufacturing	17,521				
Iron and Steel Scrap		78			
Textile Scrap	9,604				
Commodities (NEC)	45,996				
TOTAL	709,201	35,885	1,124,605	403,314	31,070,442

TABLE 11C

High Estimate - Boston Inflows - 1985

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	49,254	33,392	835		
Mining			496,124		131,881
Food and Kindred Prods.	123,859		7,741		642,516
Tobacco	78				
Textiles	39,958				
Apparel	4,381				
Lumber	9,025			216,594	
Furniture	7,448				
Paper	121,300			2,870	
Printing	4,110				
Chemicals	123,772		54,385		9,377
Petroleum					36,390,819
Rubber	10,406				
Leather	33,527				
Stone, Glass, Clay	22,467		726,425		
Primary Metals	24,521	2,043		177,778	
Fabricated Metals	70,401				
Machinery except Elect.	31,623				
Electrical Equipment	17,411				
Transportation Equipment	9,967			52,329	
Instruments	2,353				
Misc. Manufacturing	20,786				
Iron and Steel Scrap		75			
Textile Scrap	8,191				
Commodities (NEC)	47,904				
TOTAL	782,745	35,510	1,285,510	449,571	37,174,593

TABLE 11C

High Estimate - Boston Inflows - 1990

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	47,162	31,974	799		
Mining			526,094		139,848
Food & Kindred Prods.	132,856		8,303		689,189
Tobacco	74				
Textiles	36,496				
Apparel	4,534				
Lumber	9,672			232,138	
Furniture	7,932				
Paper	137,783			3,118	
Printing	4,985				
Chemicals	142,013		62,400		10,759
Petroleum					41,691,255
Rubber	11,215				
Leather	32,145				
Stone, Glass, Clay	24,619		796,015		
Primary Metals	24,510	2,042		177,697	
Fabricated Metals	74,573				
Machinery except Elect.	32,459				
Electrical Equipment	18,413				
Transportation Equipment	9,549			50,130	
Instruments	2,615				
Misc. Manufacturing	23,572				
Iron and Steel Scrap		67			
Textile Scrap	6,544				
Commodities (NEC)	46,804				
TOTAL	831,615	34,033	1,393,611	463,083	42,531,051

TABLE 11C

High Estimate - Boston Outflows - 1980

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	5,790	18,337			
Mining	5,449	1,734	5,201		
Food and Kindred Prods.	45,402	8,926	826		41,821
Tobacco	36				
Textiles	4,385				
Apparel	333				
Lumber	611			1,495	
Furniture	984				
Paper	55,355			1,712	
Printing	2,827				
Chemicals	40,179	320	1,141		4,109
Petroleum					2,166,549
Rubber	6,948				
Leather	13,818				
Stone, Glass, Clay	9,568				
Primary Metals	5,944		186	3,158	
Fabricated Metals	11,904				
Machinery except Elect	19,741				
Electrical Equipment	5,438				
Transportation Equipment	1,719				
Instruments	4,686				
Misc. Manufacturing	883				
Iron and Steel Scrap		667,442			
Nonferrous Scrap	5,082				
Textile Scrap	10,523				
Waste-Paper Scrap	2,941				
Commodities (NEC)	24,530				
TOTAL	285,076	696,759	7,354	6,365	2,212,479

TABLE 11C

High Estimate - Boston Outflows - 1985

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	5,616	17,785			
Mining	6,357	2,023	6,068		
Food and Kindred Prods.	42,722	8,399	778		39,420
Tobacco	27				
Textiles	3,815				
Apparel	333				
Lumber	619			1,516	
Furniture	1,032				
Paper	62,175			1,923	
Printing	2,979				
Chemicals	44,121	351	1,253		4,512
Petroleum					2,596,363
Rubber	6,670				
Leather	14,231				
Stone, Glass, Clay	10,546				
Primary Metals	5,705		178	3,031	
Fabricated Metals	12,647				
Machinery except Elect.	20,793				
Electrical Equipment	5,706				
Transportation Equipment	1,695				
Instruments	5,642				
Misc. Manufacturing	920				
Iron and Steel Scrap		819,240			
Nonferrous Scrap	6,230				
Textile Scrap	21,291				
Waste-Paper Scrap	3,610				
Commodities (NEC)	25,549				
TOTAL	311,031	847,798	8,277	6,470	2,640,295

TABLE 11C

High Estimate - Boston Outflows - 1990

(in tons)

Commodities	Container	General	Bulk	Neo-bulk	Liquid-bulk
Agriculture	5,248	16,620			
Mining	7,894	2,512	7,535		
Food & Kindred Prods.	39,283	7,723	715		36,186
Tobacco	18				
Textiles	3,305				
Apparel	307				
Lumber	587			1,437	
Furniture	991				
Paper	64,173			1,985	
Printing	2,931				
Chemicals	40,118	319	1,140		4,103
Petroleum					2,974,193
Rubber	6,036				
Leather	13,190				
Stone, Glass, Clay	11,026				
Primary Metals	5,081		159	2,699	
Fabricated Metals	12,887				
Machinery except Elect.	20,206				
Electrical Equipment	5,461				
Transportation Equipment	1,582				
Instruments	6,485				
Misc. Manufacturing	912				
Iron and Steel Scrap		906,873			
Nonferrous Scrap	6,890				
Textile Scrap	12,432				
Waste Paper Scrap	3,996				
Commodities (NEC)	25,002				
TOTAL	296,045	934,047	9,549	6,121	3,014,482

as the cost per ton per mile for different types of commodities by truck and rail from some median distance in each New England state to Boston and other major ports.

Port costs, such as pilotage, wharfage, and usage could be obtained for Boston and other appropriate ports. In addition to the actual port charges some measures of time variability would be helpful. This might include a measure of the average time from when a vessel entered the harbor to when the goods were loaded onto inland transportation carriers (trucks or rail). Another aspect of time variability could be the labor stability at the port, with some measure of strike days lost per year being an appropriate measure.

The third aspect of shipping costs, waterborne costs, would include both actual cash charges during transport as well as a measure of the availability of shipping to different parts of the world at different ports. It would be helpful to determine these costs for the different major commodities being shipped through the port. This model could then be used to predict capture ratio as a function of the relative costs at each port.

- Regional Imports

A second recommendation concerns the lack of good regional data on imports. Massport could use the Journal of Commerce printouts to obtain a distribution of imports by both commodity as well as by economic sector of end use. This would greatly aid in attempts to project imports.

APPENDIX B

Commodity Classifications by Cargo Type

Containerizable Low Value Commodities

Meat and meat preparations
Meat -- dried, slated or smoked
Meat -- in airtight containers, meat preparations
Milk and cream
Butter and anhydrous milk fat
Cheese and curd
Fish and fish preparations
Fish -- in airtight container, fish preparations
Rice, milled and unmilled
Cereals -- N.E.C. -- unmilled
Cereal preparations
Fruits -- dried
Fruits Nuts -- prepared or preserved
Vegetables -- roots, tubers -- dried
Vegetables -- roots, tubers -- prepared or preserved
Sugar confectionery not containing cocoa -- flavored or colored sugars
Coffee
Cocoa
Chocolate, other food preparations containing cocoa or chocolate
Tea and mate
Spices
Margarine and shortening
Food preparations -- N.E.C.
Beverages -- N.E.C. -- nonalcoholic
Beverages -- alcoholoic
Hides, skins -- except furskins -- undressed, raw or cured
Gums - excluding compounded -- semiprocessed manufactures
Fuel wood and charcoal
Wool and other animal hair
Cotton
Vegetable fibers, their waste -- except cotton and jute
Manmade fibers, their waste -- except glass
Waste materials from textile fabrics -- including rags
Nonferrous metal scrap
Animal materials -- N.E.C. -- crude
Inorganic chemicals -- except elements,oxides,hydroxides,peroxides
Dyeing, tanning extracts -- including synthetic, artificial bates
Pigments, paints, varnishes, related materials
Soaps -- cleansing, polishing, finishing preparations
Synthetic resins -- regenerated cellulose, plastic materials
Stituted leather
Unvulcan, natural or synth. rubber, vul. rubber threat-hose-tubing
Rubber manufactures -- finished -- N.E.C.
Wood manufactures - N.E.C.
Paper -- paper pulp, paperboard articles --N.E.C.
Textile yarn, thread

APPENDIX B

(continued)

Made-up articles -- wholly or chiefly textile materials -- N.E.C.
Floor coverings -- tapestries, articles of veget.plaiting materials
Clay, refractory construction materials
Mineral manufactures -- N.E.C.
Glass
Glassware
Pottery
Iron or steel hoop strip -- esc. flat wire
Iron or steel wire -- exc. insul. electric -- but incl. flat wire
Iron or steel castings, forgings -- in the rough state
Copper, copper alloys --wrought or unwrought
Aluminum, alum. alloys -- unwrought bars, rods, wire
Lead, lead alloys -- wrought or unwrought
Zinc, zinc alloys -- wrought or unwrought
Fin. Struct. parts, structures -- iron, steel, aluminum or zinc
Metal containers for storage and transport
Aluminum wire products
Steel or copper wire products
Manufactures -- base metal -- N.E.C.
Equipment for delivering electricity
Vehicles -- other than road motor vehicles, parts
Sanitary plumbing -- heating, lighting fixtures -- lamps, parts
Furniture
Military apparel of all types, materials incl. footwear

Containerizable High Value Commodities

Birds eggs
Tobacco -- unmanufactured
Tobacco manufactures
Furskins -- undressed
Textile fibers -- raw silk including cocoons and waste
Silver -- platinum, platinum group metal ores -- concentrates --waste
Vegetable materials -- N.E.C. -- crude
Radioactive associated materials
Synthetic organic dyestuffs -- natural indigo -- color lakes toner
Medicinal pharmaceutical products
Essential oils -- perfume flavor materials
Synthetic perfume, flavor materials and concentrates
Perfumery cosmetics, dentifrices, other toilet prepara. ex. soaps
Explosives, pyrotechnic products
Leather - Leather manufactures - N.E.C. dressed furskins leather
Furskins -- dressed -- including dyed
Cork manufactures -- including agglomerated cork manufactures
Cotton fabrics -- woven -- not incl. narrow or special fabrics
Text. fabrics -- woven -- not including narrow-spec. fab. other than cotton
Tulle, lace, embroidery, ribbons, trimmings, other small wares
Special textile fabrics, related products
Stones -- unworked or worked -- not set or strung

APPENDIX B

(continued)

Silver -- platinum, platinum group metals -- unwrought or partly worked
Nickel, nickel alloys -- wrought or unwrought
Tin, tin alloys -- wrought or unwrought
Uranium thorium, their alloys -- wrought or unwrought
Base metals alloys -- N.E.C. -- wrought or unwrought, waste scrap
Tools -- for use in hand or in machines
Table flatware, cutlery
Household equipment -- base metals
Power generating machinery -- other than electric parts
Agricultural machinery, appliances, parts
Office machines, parts
Metalworking machinery
Textile -- leather machinery, parts
Machines for special industries, parts
Machinery -- applicances, machine parts -- N.E.C.
Electric power machinery -- switchgear parts
Telecommunications apparatus,parts
Elec. household refrig. food freezers -- cooking equip., parts
Elec. apparat. for medical purposes -- radiological appara., parts
Electrical machinery, apparatus, parts
Railway vehicles, parts
Aircraft spacecraft, parts
Ships -- boats, floating structures
Travel goods -- handbags, other personal goods
Clothing access. -- exc. fur -- knit housefurnishing articles
Fur clothing, other artic. made of fur. exc. headgear
Footwear -- new --except military, orthopedic
Scientific med. opt. measur. control instru. apparatus -- N.E.C.
Photographic, cinematographic supplies
Motion picture film -- exposed, developed
Clocks -- exc. time-clocks, etc. -- assembled, clock watch parts
Sound recorders, reprod. musical instru. -- parts, access.
Printed matter
Articles - finished -- artificial plastic materials -- N.E.C.
Baby carr., strollers, wheelchairs, toys, games, sporting goods
Office, stationery supplies N.E.C.
Works of art -- collectors pieces, antiques
Jewelry, related articles
Manufactured articles -- N.E.C.
Special transactions not classified according to kind
Arms of war, ammunition therefore armored fighting vehicles

Noncontainerizable Commodities

Animals -- live
Barley -- unmilled
Wheat Flour -- meal -- groats
Cereal flours -- meal -- groats

APPENDIX B

(continued)

Fruits -- fresh nuts -- fresh or dried
Cork -- natural -- raw waste
Jute -- true (including true jute cuttings and waste)
Iron and steel scrap
Ores, concentrates -- nonferrous base metals
Uranium and thorium ores and concentrates
Fertilizers -- manufactured
Chemical products, materials -- N.E.C.
Pig iron, sponge iron, iron or steel powders, shot, ferroalloys
Animals -- N.E.C. -- live incl. zoo animals, dogs, cats, insects, birds
Coin other than gold not being legal tender

Neobulk Commodities

Wood -- in the rough -- split -- hewn or roughly sided or squared
Wood -- shaped or simply worked
Pulps and waste paper
Wood veneers -- plywood brds. -- imp. or recon. wood -- other -- worked -- nec
Paper, paperboard
Iron or steel primary forms
Iron or steel bars, rods, angles, shapes, sections, sheet piling
Iron or steel plates, sheet
Iron or steel rails, railway track construction material
Iron or steel tubes, pipes, fittings
Pass. cars, trucks, buses, spec. purp. veh. -- chassis with eng. mount

Dry Bulk Commodities

Wheat -- unmilled
Corn or maize -- unmilled
Feeding stuff for animals -- exclud. unmilled cereals
Oilseeds -- oil nuts, oil kernels (exc. peanuts, soy, flax)
Fertilizers -- crude
Stone, sand and gravel
Sulfur and unroasted iron pyrites
Natural abrasives -- including industrial diamonds
Crude minerals -- N.E.C.
Iron ores and concentrates
Coal, coke, briquets
Inorganic chem. elements, oxides, incl. hydroxides, peroxides
Lime -- cement, fabricated building mater. -- exc. glass, clay

Liquid Bulk Commodities

Sugar -- sugar preparations, honey
Petroleum -- crude, partly refined for further refining
Petroleum products
Animal oils, fats -- N.E.C.
Vegetable oils -- fixed, soft, except hydrogenated
Vegetable oils -- fixed -- N.E.C.

APPENDIX B

(continued)

Fatty acids -- waxes, specially treated fats, oils -- ex. petro. prod.
Organic chemicals
Mineral tar -- tar oils, crude chemicals from coal, petrol., natural gas

SOURCE: Temple, Barker, and Sloan, Inc. 1976

APPENDIX C

94TH CONGRESS
1ST SESSION

H. R. 4964

IN THE HOUSE OF REPRESENTATIVES

MARCH 14, 1975

MRS. SULLIVAN (for herself, Mr. DINGELL, Mr. DOWNING, Mr. ROBERT W. DANIEL, JR., Mr. MURPHY of New York, Mr. JONES of North Carolina, Mr. ANDERSON of California, Mr. DE LA GARZA, Mr. METCALFE, Mr. BREAUX, Mr. ROONEY, Mr. STUDDS, Mr. BOWEN, Mr. EILBERG, Mr. DE LUGO, Mr. ZEFERETTI, Mr. OBERSTAR, Mr. AUCOIN, and Mr. FORSYTHE) introduced the following bill; which was referred to the Committee on Merchant Marine and Fisheries

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A BILL

To amend the Merchant Marine Act, 1920, to establish a grant program to enable public ports to comply with certain Federal standards, to direct the Secretary of Commerce to undertake a comprehensive study of the present and future needs of public ports in the United States, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Merchant Marine Act, 1920 (46 U.S.C. 861 et seq.) is amended by inserting immediately after section 8 thereof the following new section:

"SEC. 8A. (a) (1) Any State, local government, or interstate agency or other public port authority may apply to the Secretary of Commerce (hereafter referred to in this section as the 'Secretary') for financial assistance under this subsection to assist such agency in making such improvements as may be required to any port operated by it in order to bring such port into compliance with any requirements relating to environmental protection. the public health and safety. or port or cargo security which may be imposed by Federal law. For purposes of this subsection, the term 'improvements' includes, but is not limited to, the construction, repair, or rehabilitation of port structures and areas, the training of employees, and the hiring of additional employees.

"(2) Application for financial assistance under this subsection shall be made in such manner and form as the Secretary shall prescribe.

"(3) (A) Financial assistance under this subsection shall be in the form of grants of money.

"(B) If the Secretary finds that an applicant for financial assistance under this subsection is required to make any improvements described in paragraph (1) of this subsection, the Secretary may grant to the applicant all or a part of the money applied for. Any grant made pursuant to this subsection shall be subject to such terms and conditions as the

Secretary deems appropriate to insure that the moneys so granted are used for the purposes intended.

"(C) Any agency or authority which receives a grant under this subsection shall make available to the Secretary or to the Comptroller General of the United States, or any of their authorized representatives, for purposes of audit and examination, any books, documents, papers, and records that are pertinent to the moneys received by such agency or authority under such grant.

"(D) No grant or aggregate of grants made under this subsection to any State, local, or interstate agency or public port authority may exceed $1,000,000.

"(b) (1) The Secretary shall undertake a comprehensive study to determine the immediate and long-range requirements of public ports in the United States (A) for expansion and modernization in order to meet adequately the economic and defense needs of the United States, and (B) to meet such standards as may be imposed by law for purposes of environmental protection and port safety and security. Such study shall also include a comprehensive evaluation and analysis of the amount and kinds of funding which public ports have available to them for purposes of implementing current and projected expansion, modernization, and other improvements. If the Secretary finds that public ports do not, or will not, have adequate funding capability for such implementation, he shall include in the study his recommendations for achieving such a capability; except that if the Secretary makes any recommendation for Federal participation in achieving such a capability, such recommendation may not propose any action which would disrupt the existing competitive relationship among public ports or in any manner discriminate between such ports.

"(2) In carrying out the study required under paragraph (1) of this subsection, the Secretary shall solicit the views of appropriate Federal, State, interstate, and local agencies, as well as of representatives of shipping, cargo handling, land transportation, and other interested industries. To the extent necessary, the Secretary shall consider the requirements of public ports on a regional basis in order that problems common to public ports in any region may be given particular attention.

"(3) The Secretary shall report to Congress the final results of such study not later than one year after the effective date of this section, and shall from time to time make such interim reports to Congress on the study as the Secretary deems appropriate. The final report shall, and any interim report may, contain such recommendations, including suggested legislation, as the Secretary deems appropriate with respect to Federal actions, if any, which should be undertaken to assist public ports.

"(c) (1) There is authorized to be appropriated the sum of $30,000,000 for fiscal year 1975 and each fiscal year thereafter for purposes of carrying out subsection (a) of this section.

"(2) There is authorized to be appropriated the sum of $1,000,000 for each of the fiscal years 1975 and 1976 for purposes of carrying out subsection (b) of this section.".

APPENDIX D

NOTICE AND REVIEW PROCEDURES: ARMY CORPS OF ENGINEERS

When the District Engineer has all the information he requires, he issues a public notice, unless specifically exempted. The notice is distributed to the applicant and to all interested parties. Anyone can request a hearing, which is done at the expense of the U.S. Army.

If several state agencies conflict in their comments, where there is no single state agency to provide a coordinated position, the District Engineer elicits an opinion from the Governor. If the responsible state agency fails to take definitive action to grant or deny required authorizations or to furnish comments within six months of the issuance of the public notice, the District Engineer processes the application to a conclusion.

If another Federal agency objects to the issuance of a permit which the Division Engineer deems is in the public interest, the Division Engineer advises the regional representative of that agency of his intent to issue the permit. Unless the agency responds in 15 days that it wishes to bring the matter to the Departmental level, the permit is issued. If the agency responds, the permit is issued after 30 days of the receipt of the response, unless departmental consultations indicate that the matter must be forwarded to higher authority for resolution.

Matters are also forwarded to the Chief of Engineers under four conditions:

(1) When the recommended decision is contrary to the stated position of the Governor of the affected state or of a member of Congress,
(2) When there is substantial doubt as to authority, law, regulations, or policies applicable to the proposed activity,
(3) When higher authority requests it, or
(4) When the case is recognized to be highly controversial or litigation is anticipated.

If the proposed activity consists of the dredging of an access channel and/or berthing facility associated with an authorized Federal navigation project, the activity is included in the planning and coordination of the construction or maintenance of the Federal project, to the maximum extent feasible. Separate notice, meeting or hearing and environmental impact statement is not required for activities so included and coordinated.

However, in practice, coordination of Federal with non-Federal projects is difficult and rarely done.

The preceding summary is based on the July 25, 1975 regulations and conversations with USACE Staff. New regulations for Corps permits for activities in navigable or ocean waters will be published in the spring, as will a pamphlet summarizing the regulations and the permitting process. These new regulations will probably not be significantly different from the present regulations. However, it is uncertain what will happen in the future, given the new Administration and the push there has been in the last couple of years to give the states more authority, especially in the area of disposal of dredged or fill material in navigable waters.

APPENDIX E

STATE REGULATORY PROCESSES APPLICABLE TO MASSPORT: A Brief Summary

1. Chapter 21, s.43 -- Division of Water Pollution Control, DEQE
   - a. Sewer Connection/Extension
     - applies to: connections to an already existing system to carry only sanitary wastes if the flow exceeds 2,000 gallons/day. Any connection to convey any industrial wastes requires a permit.
     - time*:3-6 months.
     - criteria: approval of municipal/district sewage system owner
   - b. National Permit Discharge Elimination System
     - applies to: point source discharges
     - time*:approximately 6 months
     - criteria: discharges conform to state and federal water quality standards.
   - c. Water Quality Certification
     - applies to: any construction in Massachusetts waters which may result in discharges to navigable waterways and requires a federal permit.
     - criteria: discharges meet State standards.
2. Chapter 91 -- Division of Waterways, DEQE
   - a. Construction - s.14-18, 20-23
     - applies to: construction of structures below highwater mark, filling of land/flats, driving of piles in/over tidewater.
     - criteria: structure not encroach on public's rights in navigable waters and poses no threat to public safety; (note: fees assessed for water displacement and occupation of tidelands)
   - b. Dredging - s.52-55
     - applies to: all dredging and dredge disposal carried on in Massachusetts waters
     - criteria: protection of water quality and navigational safety

3. Chapter 111, s.142 A-E -- Department of Air and Hazardous Materials, DEQE

   a. Source Registration

      applies to: all facilities emitting air pollutants

      criteria: conformance with Federal new source performance standards, national emission standards for hazardous pollutants, NAAQS, Massachusetts Emissions Limitations.

4. Chapter 131, s.40-42 -- Wetlands Protection Program of Local Conservation Commissions

   applies to: any work done in any bank, wetland, beach dune, flat, marsh, meadow/swamp bordering on the ocean or any estuary or river; or land subject to tidal action (note: "bordering" is defined as 100 feet inland from the 100 year floodline, i.e., the highest point the river/ocean reached in the last 100 years)

   time*: approximately 3-4 months, assuming an appeal of the initial order of conditions

   criteria: all local permits, variances, etc., obtained

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*We would like to emphasize that time estimates are highly unreliable for two reasons:

1) It is extremely difficult to estimate the length of time needed to review an application and to consider what conditions must be met in order for a permit to be issued without at least preliminary design specifications and a definite site;

2) The procedure is very new, and while it is possible to project the length of time taken to receive an Environmental Authorization as no greater than the time necessary to secure the most time-consuming permit, since the reviews are planned to be simultaneous, its novelty may cost some time, at least initially. (Note: to date, no multiple permit activities have gone through the process.)

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